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The primary objective of this report is to consolidate current Corps information on the inland waterway system and to present a readable presentation of the program. Primary emphasis is given to the fuel taxed inland waterway system. A companion document on the Great Lakes is ready for publication and will be distributed concurrently with the 1992 Inland Waterway Review.

The overall purpose of this report is to provide an overview of the inland waterways sytem. To make the report most useful for that purpose, it presents the reader with information that is intended to be the best combination of brevity and completeness needed to understand and evaluate the system. The report covers all important aspects of the waterways system, and provides a level of detail consistent with its purpose. In the interest of brevity, it contains a minimum of analyses, and as a result, no new or remarkable findings. Observations and interpretations of the information are in this Executive Summary.

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EXECUTIVE SUMMARY

REVIEW PURPOSE AND APPROACH

The primary objective of this report is to consolidate current Corps information on the inland waterway system and to present a readable presentation of the program. Primary emphasis is given to the fuel taxed inland waterway system. A companion document on the Creat Lakes has been published and will be distributed concurrently with the 1992 Inland Waterway Review.

We have used Lock Performance Monitoring System (LPMS) and Waterborne Commerce Statistics data supplied by the Navigation Data Center, CEWRC-IWR Corps and outlay data and status reports from the latest available information presented to Congress and the Inland Waterways Users Board by the Corps.

The overall purpose of this report is to provide an overview of the inland waterways system. To make the report most useful for that purpose, it presents the reader with information that is intended to be the best combination of brevity and completeness needed to understand and evaluate the system. The report covers all important aspects of the waterways system, and provides a level of detail consistent with its purpose. In the interest of brevity, it contains a minimum of analyses, and as a result, no new or remarkable findings. Observations and interpretations of the information are in this Executive Summary.

The physical, functional, and fiscal aspects of the system are covered in separate chapters. The focus is to provide perspective, and the effort has been to provide a balanced presentation of the most relevant information.

The report contains seven chapters and five appendices. The report is organized to treat specific aspects of the waterways system in separate chapters. Appendices A through E provide supplementary statistics on the physical system, the Lock Performance Monitoring System (LPMS), Inland Waterways Trust Fund Analysis, the 1991 Annual Report of the Inland Waterways Users Board, and the assignment of new WCSC commodity codes to Corps commodity groups.

CHAPTER SUMMARIES

To make the Executive Summary a useful stand-alone document, the following summaries of the seven chapters provide some highlights and statistics.

Chapter 1. Introduction. A perennial problem in dealing with the inland waterways system is that it is not perceived as the same thing by the different parties who are interested in it. Primarily it is a collection of water resource development projects which include inland navigation as a project purpose along with other purposes that are the responsibility of the Corps of Engineers. There are good reasons for this practice, but it makes it very difficult to view the Inland Waterways as a complete system.

Congress provided a solution to the definition problem when it specified the waterways subject to fuel tax, made those waterways eligible for improvement using the Waterways Trust Fund, and exempted studies of improvements on those waterways from cost-sharing. These fuel tax waterways are parts of larger waterway and transportation systems, but Congress has identified the fuel tax waters to be of national importance. This set of waterways is a distinct system because its improvement and planning differ from other waterways. It is the repository for most Federal investment in inland waterways, and it accounts for almost all contribution of inland waterways to U.S. transportation. It is in fact the inland waterways system. The set of waterways subject to fuel tax is a useful definition of the waterways system, and that is the definition used for the purposes of this report.

The role of the waterways system in water resource development and transportation is unique. To a greater degree than many other resource development projects, waterway navigation projects provide immediate commercial benefits. To a greater degree than other parts of the transportation infrastructure, the waterways have high use and value for purposes other than transportation. These include municipal and industrial water supply, recreation, and fish and wildlife. Along with other resource development projects and transportation modes, the fundamental purpose of waterways is economic development. The distinctive attributes of waterways are their multiple uses. A flaw in current waterway statistics is that they measure the value of waterways only in terms of freight transported. Statistics for additional uses are generally available only where there is competition for waterway use. The high degree to which multiple uses of the waterways are compatible is understated, as is the military defense value of the waterways.

Measured only in freight transportation statistics, the waterways are one of the smallest components of the U.S. transportation system. They are one of our oldest transportation modes, and still the most efficient in terms of resource inputs required to produce ton-miles. The waterways are ideal for transporting large tonnages over long distances. They still show growth in tonnage transported and transportation modal share, but the waterways are now just one of several transportation alternatives available to most shippers. For the shippers who can use the waterway system, it provides a low-cost alternative. It is an important factor in assuring the Nation of a highly competitive and efficient transportation system. Comparative ton-miles and traffic share for the waterways and other transportation modes are presented in Table ES-1.

Chapter 2. Institutional Infrastructure. The basic reason for Federal participation in the waterways system is to encourage commerce and enhance the public's well-being by facilitating transportation. The Federal participation is limited to developing, funding and operating the waterways, or vessel routes. Private carriers provide towboats and barges, and various combinations of non-Federal public and private organizations develop, fund and operate the inland waterway ports. In this respect, the waterways are similar to the U.S. highway and airway systems. Unlike the other two transportation modes, Federal participation is through the water resources development program.

TABLE ES-1. DOMESTIC INTERCITY FREIGHT TRAFFIC BY TRANSPORTATION MODE, SELECTED YEARS, 1970 - 1990

Type of Transport	Ton-Miles (billions) 1970	1980	1989	1990[a]	Percent Distribution 1970	1980	1989	1990[a]
Railroads	771	932	1,048	1,071	34.9	31.1	33.0	33.4
Highways	412	555	716	735	18.6	18.5	22.6	22.9
Waterways	156	227	272	283	7.1	7.5	8.6	8.8
Other Waterborne	439	693	542	527	19.8	23.1	17.1	16.4
Pipelines	431	588	584	583	19.5	19.6	18.4	18.2
Airways	3	3	10	10	0.1	0.2	0.3	0.3
Total	3,209	2,212	3,172	3,209	100.0	100.0	100.0	100.0

Sources: Transportation in America, Ninth Edition, Supplement December 1991, Published by ENO Transportation Foundation, Inc. Westport, CT
a/ Estimate.

The Federal government is the biggest single participant in the waterways system based on investment, but the combined investments of other participants, predominantly private enterprises, are as large or larger on a current annual basis. In this respect, the waterways system approximates an equal partnership. The Federal participation is through the Army Corps of Engineers, the Tennessee Valley Authority and the Department of Transportation's Coast Guard and Federal Maritime Administration. The latter two agencies are responsible for navigation safety, and encouraging development of waterway vessels and port facilities. The Corps' responsibility is the improvement and operation of the waterways. Its responsibilities account for most of the Federal expenditures on the system, and its waterway improvements largely determine how well the system will function.

The locks and dams provided by the Corps of Engineers are the most important features of the waterways system in terms of investment and impact on how the system operates. The Corps also provides a variety of other improvements, the most important of which are bank stabilization and river training works. The latter are wing dams and similar structures which help the natural channelization process and reduce the dredging needed. These improvements and Corps operations are spread over 11,000 miles of system. The cumulative investment in the improvements is approximately $11 billion. Current reproduction cost is on the order of $40 billion. Corps expenditures on the system in Fiscal Year 1991 were $528 million for construction and $426 million for operations and maintenance. About one-fourth of the construction costs were funded from the Inland Waterways Trust Fund. About 2,750 Corps employees are directly involved in operations and maintenance. Construction is by contractors, but the oversight of construction and administration of the system involves 2,500 additional Corps employees.

Private enterprise is the second biggest participant in the waterways system, and biggest by some measures. It is responsible for providing and operating all of the vessels and most of the port and cargo facilities. State

and local authorities have provided some port facilities. The enterprises involved span a wide range of sizes and activities. Some of the largest and smallest firms are directly engaged in vessel operations, but pressures to improve efficiency are concentrating vessel operation in fewer but larger firms. Over the past decade, the number of towing firms declined 30 percent. The largest operators include coal, grain, and utility companies, as well as transportation enterprises. A large number of small firms provide the support services for vessel operations; including fueling, repair and construction of vessels, and cargo terminal operations. The total number of individuals involved in vessel operation and supporting services is about 50,000. Total private sector employment associated with the waterways system is estimated to be about 175,000.

The waterway vessel fleet in the private sector includes about 30,000 barges and 5,000 tugs and towboats. There are about 2,500 cargo facilities on the waterways system, and predominantly they have been provided by private enterprises. The actual investment in waterway vessels and cargo facilities is unknown, but replacement costs have been estimated at $7 to $15 billion for vessels, and $15 billion for facilities. The economic life of the vessels and terminal equipment is significantly shorter than the Corps structural improvements to waterways. Actual annual replacement or expansion of the fleet and facilities has varied widely depending on trade conditions and profit prospects. However, based on the economic life of the vessels and facilities, the average annual expenditures required for replacement would be about $550 and $300 million, respectively. That compares with total Corps expenditures on the waterways system in Fiscal Year 1990 of $751 million.

The perception of the waterways system as an economic development asset has shaped the role of *state and local governments*. Both have been proponents of waterways system expansion. A few state governments, but principally local governments, have been sponsors of port developments and related Corps projects. The study and project cost sharing required by the Water Resources Development Act of 1986 (P.L. 99-662) is likely to alter the role of both state and local governments. The immediate impact has been on local authorities because inland harbor projects, or any waterway improvement not on the mainstem of the fuel-taxed system, are now subject to the same type of cost sharing that applies to coastal harbor projects. The ability of local authorities to fund 30 percent of the Federal project, in addition to the land improvements and cargo facilities that they have been funding, is in question. The historical role of states has been as project proponents only. The greater funding capacity of state governments may be needed in some project sponsorships, as in the deep draft projects in Maryland, Virginia, Alabama, and Louisiana. This is particularly true when waterway projects involve multiple local jurisdictions.

The Inland Waterways Users Board became another participant in the waterways system as a result of the Water Resources Development Act of 1986. The Act created the Board to serve as a voice for those waterways users paying waterway user fuel taxes. The Board is charged with advising Congress of the users' priorities for waterway improvements. The Board's recommendations reflect its view of the waterways as a transportation system, and Congress has to balance a broader array of concerns. The Board's concern with

transportation efficiency can be, and has been, incorporated into the Corps planning process. Integration of Board priorities into the investment decision process will depend on Congress.

Chapter 3. The Waterways System. The waterways system consists of three geographical groupings of waterways that function more-or-less independently of each other. Each regional subsystem has certain distinctive characteristics. The Mississippi River and its tributaries, and the Gulf Intracoastal Waterway and the rivers that intersect it, are an interconnected network of waterways that accounts for about 86 percent of the route length of the overall system, and a higher percentage of overall system commerce. These waterways are a highly developed transportation system, with large and diverse commodity movements, and economy of scale through use of a large, modular, fleet of vessels. Predominantly the commerce is domestic, but the waterways also carry foreign trade that moves through Gulf Coast ports.

The Atlantic Intracoastal Waterway is the second largest regional subsystem in terms of route length, with about 11 percent of the system total, but it is a distant third in waterway commerce. The rivers that intersect this waterway are relatively short, and waterway traffic is predominantly domestic commerce moving north or south. The AIWW links seaports from Miami to Norfolk, and basically it is an alternative to deep-draft coastwise navigation.

The Columbia-Snake Rivers System in the Pacific Northwest is the smallest subsystem in length, but it shares many attributes of the Mississippi River system. It has its own unique sizes and style of waterway vessels, and links deep water ports on the lower Columbia with inland ports in Washington, Oregon, and Idaho. To a much greater degree than the other regional systems, its commerce is export-import oriented.

To some degree, all waterways in the system have been improved to facilitate navigation. The improvements include channel straightening and training works in open rivers such as the Missouri and Lower Mississippi, dams to regulate water levels on most of the riverine waterways, the new waterways or canals to provide connecting links (the Tennessee-Tombigbee). Locks are required at inland dams, and at certain river intersections on the coastal waterways. These locks, and the dams associated with them, represent most of the Federal investment in waterway improvements. The locks also have the most impact on how the system operates. The dimensions and numbers of lock chambers influence tow sizes, and usually determine system throughput capacity.

The fuel-tax inland waterways system has a total of 211 lock chambers at 168 lock sites. The great majority of these are on the Mississippi-GIWW system, 200 lock chambers and 157 lock sites, respectively. The number of chambers exceeds lock sites because additional chambers are provided at some locations for additional or reserve capacity, typically main and auxiliary chambers of unequal size. One obsolete lock on the Willamette has a series of low-lift chambers. The ages of system lock chambers range from the new Oliver L&D on the Black Warrior River to the 150+ year old locks on the Kentucky River. The median age for all chambers is about 35 years. Lock age alone is

not the controlling factor. The controlling considerations in lock replacement are condition, capacity, and the degree to which the facility constrains present and projected navigation traffic. Predominantly, locks have been replaced to provide better service or greater capacity, not because of major structural problems in the original locks.

The performance of the waterways system depends on the performance of locks, the ability of the Corps to maintain channel depths, and the ability of vessel operators to use the locks and channels efficiently. Chapter 3 provides statistics on all three aspects of performance.

Adequate underkeel clearance of at least two, and preferably four feet or more, has a significant effect on barge tow propulsion effort. Normally, the dams on controlled rivers provide pools of adequate depth, and the training works on open rivers help nature to scour channels in the right places. Ideally, the dams and training works would eliminate all dredging on rivers--and everyone would be happier. A basic law of nature is that silt in a river will come out the river's end, eventually. Nature moves sediments downstream in waves of alternating scouring and shoaling, and uses serpentine river bends to speed the flow of water and silt. Part of the Corps expertise is in helping nature do that more efficiently. The drought of 1988 disrupted the natural process with record low water in the open rivers, and required a substantial dredging effort.

Statistical data on the performance of locks is provided from the Corps LPMS. This is a comprehensive collection of statistics on lock operations. With proper analysis, the lock data can provide systemwide comparisons for identifying problem locks that may need remedial work, replacement, or added capacity. There are a number of measures that identify problems, no one of which is conclusive. Planning studies are needed to determine if a large amount of delay time or lengthy processing time is because the lock is too slow or too small or because tow arrivals are peaking. Tables in the chapter show the "top" locks based on utilization statistics and problem indicators. Overall, the busiest locks are not the ones with the most problems; the locks that rank high with any one problem indicator are likely to rank high in other problem indicators. The number of locks that are above average in inefficiency measures ranges around 20. In terms of the overall system, a small number of locks accounts for most of the high values.

The chapter describes the composition of the inland waterways vessel fleet, and provides an analysis of capacity utilization on the Mississippi River-Gulf Intracoastal Waterway system. That region employs about 88 percent of all barges in the U.S., and over 62 percent of all towboats. The barges on that system are highly standardized as to size, predominantly 195 by 35 feet, and the variety in towboat sizes enables operators to match horsepower with the tow sizes used on individual waterways. The Columbia-Snake system fleet is also highly standardized, including tow and towboat sizes and a unique barge size, because almost all lock dimensions are the same. The Atlantic Intracoastal fleet is a mixture of barge and tug/towboat sizes because many vessels operate in harbors and coastal waters as well as in inland waterways.

The analysis of fleet utilization identifies a large amount of underutilization as a result of fleet expansion during the late 1970s and early 1980s and sharp decline in traffic as a result of the downturn in the business cycle starting in 1982. This coincides with the apparent increase in fuel efficiency indicated by waterway fuel tax receipts. The equipment surplus may explain part of this phenomenon because it enables operators to improve integration of barge tows. That includes optimal matching of square and shaped barge ends, and uniform loading of barges. The ability to present a clean, smooth, underwater surface can reduce propulsion requirements significantly. Additionally, the surplus of equipment and consolidation of operators contributes to a better matching of towboat power and tow size. Tow speeds also were reduced to conserve fuel.

There are continuing pressures to improve the efficiency of barge and towboat operations, and fuel efficiency is one of the more visible signs of progress. The equipment surplus reduced during the late 1980s through traffic growth and equipment retirement nearly disappeared. Towboat and barge construction has begun after several years of no new building.

Waterway operators have continuing fuel conservation programs. There is increasing use of computers by waterway operators ashore and on towboats to optimize tow speeds based on underkeel clearance, river currents, and traffic conditions. There is a potential for significant additional improvement in vessel operations, and this will enhance system performance also.

Chapter 4. Inland Waterway Traffic: Historic Trends and Projections. Waterway commerce statistics and analyses rely on data collected by the Corps of Engineers. Statistics are published annually in Waterborne Commerce of the United States. The Corps is the only source for comprehensive data on domestic waterborne commerce, and its publication is the only source for multi-year series of commodity statistics. As a result, it is sometimes necessary to use statistics for a category called "Internal" in the Corps publication. The inland waterways system, as defined by Congress and by fuel taxes collected, is a subset of "Internal" traffic, and the latter includes certain coastal bays and sounds as well as inland waterways. This chapter occasionally uses internal statistics, and they are identified as such. Comparative 1980-1990 statistics are presented in Table ES-2.

In terms of tons and ton-miles, 1990 internal traffic and inland waterway system traffic were both at record highs. The fuel-tax waterway system traffic has grown somewhat more robustly than internal traffic in the years shown, and now accounts for about 84 percent of internal tons and 92 percent of internal ton-miles.

Waterway traffic grew consistently in the 34-year period from World War II through 1978, and the average annual growth rate for "Internal" tonnage was 4.2 percent. Growth was interrupted thereafter, and tonnage alternately plateaued and fluctuated through 1985. Internal and fuel-tax waterway system tonnages have both grown since then, and the average annual growth rate for the 1981-1990 decade was about 1.9 percent ("Internal" tonnage). A number of factors were responsible for the traffic fluctuations in that period. Careful analysis of these factors is required to produce valid waterway traffic

TABLE ES-2. WATERWAY TRAFFIC STATISTICS FOR INTERNAL TRAFFIC AND TRAFFIC ON FUEL-TAX WATERWAYS, 1980 - 1990

	Internal Traffic				Fuel Tax Waterways			
Year	Tons (000)	% Change	Ton-Mi (000,000)	% Change	Tons (000)	% Change	Ton-Mi (000,000)	% Change
1980	535,000	-	227,000	-	NA	-	NA	-
1981	520,669	2.68	231,184	1.84	427,349	NA	208,737	NA
1982	495,453	-4.84	217,027	-6.12	404,499	-5.35	196,582	-5.82
1983	487,132	-1.68	225,628	3.96	404,118	-0.09	205,865	4.72
1984	542,503	11.37	242,855	7.64	446,934	10.60	222,529	8.10
1985	534,658	-1.44	232,708	-4.18	446,515	-0.09	214,260	-3.72
1986	560,499	4.83	248,117	6.62	467,533	4.71	229,178	6.96
1987	569,827	1.67	257,336	3.72	472,274	1.01	236,474	3.18
1988	588,119	3.21	269,036	4.55	490,893	3.94	246,995	4.45
1989	606,006	3.04	272,157	1.16	497,838	1.41	NA	NA
1990	618,314	2.03	NA	NA	522,417	4.94	NA	NA

SOURCE: WCSC
NA = Not Available

projections. Chapter 4 identifies these factors, with analyses of the major commodity categories within the traffic total.

Commodity analysis by the Corps for projection purposes involves trend analysis and evaluation of the analyses and forecasts by various economic research firms. The individual growth rates of major commodities are the basis for projections to the year 2000 for all internal traffic, and traffic on nine waterway system segments. The projections for internal traffic show the differential growth rates of major commodity categories, and total projected internal traffic is based thereon. The projections for the nine system segments are for total traffic only, based on the mixture of commodities involved. The waterway projections are presented as a high-low range, and this is the integrating device used to harmonize national projections with segment-specific projections and forecasts used in regional waterway planning and project specific studies. One of the challenges in Corps planning for a waterway system covering a large geographical area is to assure that the sum of the traffic estimates made by Corps Divisions does not exceed the total estimated at the national level.

The projections for total internal traffic center on an annual growth rate of about 1.5 percent. Most individual waterway segments have higher growth rates. The projections are for tons, not ton-miles, and the total tons of the nine segments exceeds the inland total to the extent that some traffic moves on more than one segment. Use of ton-miles instead of tons would be a way to eliminate such double-counting in projections, but it is impractical to do so because virtually all statistics used for commodity analysis and forecasting are stated in tons. In general, growth of ton-miles parallels that of tons, but limited studies indicate differential growth in the average length of haul for specific commodities.

Waterway commodity projections include some negative as well as positive growth rates. Farm products are expected to have the greatest growth, centered on three percent per year. Crude petroleum is expected to show the greatest decline, with a negative annual "growth" centered on two percent. Overall, the waterway projections produced by the Corps are consistent with the present opinion of economic forecast experts. Very few of their projections relevant to the waterways system are very far from the Corps overall mid range. Most forecasting services now project grain traffic, primarily for export, to increase at a moderate rate of two-three percent per year. They project coal traffic for power plants and exports to grow at about two percent per year. With the implementation of the Clean Air Act of 1990, the blending of low sulfur, low BTU western coal with low and medium sulfur high BTU eastern coal will likely increase the ton miles of coal traffic on the waterway system.

The Corps projections for the waterways reflect the considered judgment of a number of experts. In the long run, they should be as accurate as any projections now available. In the short run, actual traffic undoubtedly will fluctuate up and down around the projected trend. Waterway traffic is affected by a large number of factors; the drought in 1988 and high water conditions in 1990 are just two in addition to export market variations and changes due to the Clean Air Act. The point to remember is that irregularities in the growth pattern are normal, not exceptional.

<u>Chapter 5. System Needs Assessment</u>. Historically, the opportunities to improve waterways by extending or deepening them, or adding or replacing locks, have exceeded the willingness of the Nation to pay for the improvements. The Corps planning process uses investment criteria developed pursuant to the Water Resources Planning Act of 1965. The evaluations determine whether the benefits to the Nation exceed the costs of the project. Those costs include all costs, regardless of whether they are paid only by the Federal government, or by a combination of Federal and non-Federal funds. However, the investment criteria do not consider the availability of those funds, nor do they identify which projects to build with available funds. The result has been a significant number of projects that have been evaluated and found justified, waiting for authorization and funding by Congress. This list of projects had some usefulness in providing flexibility in matching projects to available funds. It also had some significant costs, in unnecessary planning effort, and more important, lost project benefits when projects were not built in optimal sequence.

An unintended effect of this list of projects has been to fuel debates over where the money to build all of the projects would come from. As competition for Federal funds increased, it became clear to the Corps that a planning process that produced a long list of "justified" projects in excess of the number of projects which can be funded was unproductive. Higher levels of interest rates had a profound effect on project benefits, and produced a need to accelerate construction of the projects that would be built. The accepted solution was to accelerate planning and construction, and focus on fewer projects at any one time. For planning, this implied starting the "best" projects through the process at the appropriate time. Ideally, it meant starting only the right projects through the process. Neither the Water

Resources Planning Act nor the Congressional Authorization process provides for a prescreening of studies--nor does either preclude it. The real challenge for the Corps was to extend screening over a wide spectrum of studies, and to identify the total number of studies needed at any one time.

The Water Resources Development Act of 1986 provided the impetus to apply system analysis to waterways planning. The Act identified a specific set of waterways as the system. The Act also set a precedent for use of the Waterway Trust Fund, whereby the number of studies needed became much more predictable. The tools for system analysis and screening of waterways studies were available. They had been developed and used on a regional basis, but until the 1986 Act, there was no basis or need to apply them to a larger system. The compelling need to use them was to provide a way for all interested parties to explore the priorities of the waterway system--the Waterways Users Board, created by the 1986 Act; the Corps; and hopefully, Congress. The needs assessment that is underway is a complex effort and will be a significant technical achievement. However, the process involved is more important than its results. Its greatest significance will be if it provides an orderly way to determine system priorities and improve investment decisions.

The assessment is divided into three phases: identification of systemwide needs and potential projects; the determination of the optimal sequence or priorities for improvement projects; and, optimization of the system improvements and integration into an ivestment plan. The third phase is complete, and the findings presented in Table 32 indicate that 11 prospective lock replacements over the time frame 1996-2020 will cost $4.3 billion (October 1991 estimate).

Of necessity, the needs assessment used generalized estimates of project costs in the determination of benefits and costs to identify potential projects. In almost all cases, cost estimates were based on comparable actual work rather than on engineering analysis. Any such costs, if shown, require the disclaimer that they represent costs for illustrative purposes only, and do not reflect economic justification of the projects, or intent by the Corps or Administration to request funds, or imply any further actions based thereon. Use of the costs outside this review could, in fact, create confusion and be misleading.

The investment needs assessment when coupled with the Trust Fund resources likely to be available suggest that a balanced investment strategy should: (1) include a strong program of rehabilitation of existing locks, (2) include small scale investment measures that add small increments of capacity to existing locks to defer the need to build larger locks; and, (3) slowly add larger lock chambers when capacity or condition problems overcome the existing locks ability to serve traffic efficiently. Fuel tax revenues are not now geared to increase with inflation; therefore in the coming years, they will purchase fewer projects. At best, the Inland Waterways Trust Fund will pace the rate at which all forms of investment in the fuel taxed waterway system can be implemented. Considerable effort will be required of the Corps, the Inland Waterways Users Board and the U.S. Congress to guide the investment program.

Chapter 6. Waterway Programs and Funding. In the past 12 years, annual expenditures by the Corps of Engineers for operation of the waterways system have grown consistently, and annual expenditures for capital improvements have declined almost as consistently, except for FY1988-1991. O&M expenditures almost doubled in the period, and were $426 million in Fiscal Year 1991. Construction expenditures in Fiscal Year 1991 were $528 million. About one-fourth of the construction costs came from the Inland Waterways Trust Fund. The $528 million was 24 percent above the $427 million of construction expenditures in FY1980.

Total expenditures for the system in Fiscal Year 1991, O&M and construction combined, were about 63 percent above Fiscal Year 1980. Adjusted for price levels with the GNP deflator, total 1991 expenditures were less than 1980 expenditures. Similar trends apply in expenditures for other waterways and all types of Corps navigation projects. Over the 1980-90 period, the total number of Corps Civil Works employees (full time equivalents) declined 12.5 percent. The number of employees or FTE's in waterways system activities in the earlier year is not available, but the decline in waterways-associated employment is believed to be similar to the overall decline. During the last ten year period, use of the waterways system has increased about 25 percent, measured in ton-miles.

All O&M expenditures are being given a new, high level of scrutiny, because they are now the biggest single area of Corps expenditures. The growth in waterways system O&M reflects a combination of cost inflation, additions to the system (the Tennessee-Tombigbee, and partial completion of the Red River Waterway), and rehabilitation funded via O&M. The average annual increase for 1981-1990 was about 5.0 percent. Analysis of the expenditures does not show any discernable correlation between increasing costs and the age of the system, although individual locks may be exceptions. Allowing for the additions to the system, it appears that system O&M grew at a rate close to the construction cost inflation that prevailed (5.2 percent, based on the Engineering News Record construction cost index). The recent high levels of O&M in fiscal years 1988 and 1989, were in part due to the extraordinary amount or dredging as a result of the 1988 drought. Weather conditions and water levels, more than any other factor, account for year-to-year fluctuations in O&M. The underlying trend is likely to reflect inflation.

Other Corps waterways activities, such as construction, rehabilitation, and studies, are described in separate sections of Chapter 6. The descriptions include information on all relevant projects and studies. Some of the waterways are not within the fuel-taxed system, but functionally they interact with it and are relevant. All of the construction on the fuel-taxed system is described. The construction funded via the Waterways Trust Fund, and the construction not so funded, are treated separately. The descriptions also distinguish between studies that are relevant to the system needs assessment, and those that are not.

Several construction projects and studies are described explicitly in this chapter. With the exception of a few generic studies that are principally concerned with water resource management, the studies relate to potential

construction projects. There is a wide geographical spread to the projects under construction, and an even greater spread to the combination of actual and potential construction. Virtually every waterway in the system has, or may have, one or more improvement projects. The distribution of studies and work underway is uneven, because of some earlier limitations. A specific limitation was a moratorium on improvements on the Upper Mississippi until completion of the Environmental Management Plan. There are no present planning limitations, and the system needs can be addressed in an orderly way, regardless of location.

Reconnaissance studies of the Upper Mississippi and Illinois Waterways began in 1990. The total potential construction that will be identified as a result of the studies would be an interesting statistic, but it would only support the need for setting priorities. Based on the Trust Fund analysis in the following chapter, annual expenditures for construction in the near future are likely to approximate the $140 million in Fiscal Year 1991.

The annual expenditures for waterways system O&M and construction are both reasonably predictable. The chapter contains some very large numbers. To put them into perspective, the comparative Federal investments by transportation mode are presented in Table ES-3.

TABLE ES-3. 1990 NET FEDERAL EXPENDITURES FOR FREIGHT TRANSPORTATION

Mode	Total Expenditures[a]	Carrier Ton-Mile[a] Revenues
Aviation (scheduled)	5,586	46.34
Trucking (Class I)	15,000	24.38
Rail (Class I)	1,118	2.66
Inland Waterway	1,097	.77
Oil Pipelines	-0-	1.44

Source: Transportation in America, Ninth Edition, 1991. ENO Foundation, Westport, CT., Updates as of September 1991. p. 12.
[a]/Total Expenditures in millions of dollars and ton mile carrier revenues are in cents.

The source used by DOT for the data in Table ES-3 has allocated Federal expenditures between personal or passenger transportation and freight transportation, but does not appear to have accounted for other uses that apply on waterways, such as water supply and recreation. To that extent, waterway expenditures may be overstated. Effectively, Federal expenditures represent all government expenditures on the waterways system. State and local government net expenditures for transportation are not significant except for mass transit and highways.

Chapter 7. Status of the Inland Waterways Trust Fund. The Inland Waterways Revenue Act of 1978 (P.L. 95-502) imposed waterway user fuel taxes on certain waterways specified therein, and authorized creation of the Inland Waterways Trust Fund to provide a vehicle to utilize the tax revenues to pay

for waterway improvements. The Water Resources Development Act of 1986 (P.L. 99-662) extended the power within Congress to authorize use of the Fund to appropriations committees in addition to public works committees. The Act set a precedent for funding 50 percent of project costs from the Trust Fund, and 50 percent from the General Fund. It also extended fuel taxes to the Tennessee-Tombigbee Waterway. The Trust Fund was actually established in February 1981, with the initial transfer of tax revenues. Total tax revenues through Fiscal Year 1991 were $465 million. Total withdrawals from the Fund through Fiscal Year 1991 were $415.2 million.

The Inland Waterways Trust Fund is an invested fund. Any unexpended balance in the Fund is invested in interest bearing obligations, and Fund revenues are a combination of taxes and interest earnings. The Treasury Department is responsible for administration of the Fund, including investment of revenues and accounting for receipts and expenditures. The Corps of Engineers is responsible for determining the timing and amount of Fund expenditures, and preparation of the annual budget submission to the Office of Management and Budget and to Congress. Fund expenditures are transferred to the Corps of Engineers for disbursement to contractors, or to reimburse the Corps Civil Works Revolving Fund for inhouse costs. In either case, no amount may be transferred out of the Trust Fund unless the law authorizing the Corps expenditure authorizes use of the Trust Fund. A memorandum of understanding between the Corps and Treasury requires a transfer request that details the purpose of the expenditures, and specifies a notification period to give Treasury adequate time to liquidate sufficient investments.

To date, use of the Inland Waterways Trust Fund has been authorized for 11 waterways system projects. Ten of the projects have progressed to the point where annual construction expenditures are scheduled for budget purposes, and estimates of their cost are reasonably precise. The additional project is the Inner Harbor Canal Lock at New Orleans, where the exact location and lock configuration are still to be determined. The analysis of the Trust Fund has projected the scheduled expenditures out to the completion of construction in the year 2010 to show the effect on Trust Fund balances. To identify the funding limits of the Fund, three additional projects now under study, and which could be started and completed within the same time frame, have been included. The analysis shows that funding will be a substantial constraint on implementing more than 4 to 6 major improvement projects per decade, depending on actual tax receipts and construction cost inflation. There will likely be $200 to $300 million per year, or $2 to $3 billion per decade, of improvements that can be funded, assuming a 50 percent share is drawn from the Trust Fund.

The Trust Fund analysis illustrates the impact of construction cost inflation, and the importance of the assumptions as to revenue growth and interest and inflation rates. The cost of the 11 scheduled projects is $4.3 billion, adjusted for inflation. The analysis uses the construction inflation rate provided by OMB for budget purposes. The rate is 2 percent per year, and, historically, construction inflation has been higher. Actual, fully funded costs are likely to be greater than those shown, and the number of additional, unscheduled projects that can be started will be less.

The best projects to build with available funds are to be determined by the definitive needs assessments that is underway. Chapter 7 explains the assumptions used to estimate fuel tax revenues, and interest earnings, and the basis for the interest and inflation rates. There are numerous combinations of projects and alternate scenarios that can be analyzed. However, in the absence of a fundamental change that would require Congressional action, such as a change in fuel tax rate, or the Trust Fund cost share, or the need to maintain a positive Fund balance, the indicated annual and decade funding levels apply. In brief, it is likely that fewer construction projects can be started than can be economically justified.

CHAPTER 1
INTRODUCTION

1.1 PURPOSE

This chapter provides a brief explanation of the waterway system and its role as part of our Nation's water resources and transportation infrastructure. Subsequent chapters cover the following subjects:

- Institutional Infrastructure: the human resources and government and private entities that are involved in developing, operating, and maintaining the waterways system.
- Physical System: the combination of natural and deepened channels, locks and dams, waterway vessels, and port facilities that function as an integrated system.
- Waterways Commerce: historical statistics and traffic projections for the waterways system and its components.
- System Assessment: the Corps of Engineers planning process, how it identifies potential waterways improvements, and the results of the Corps needs assessments.
- Waterways Programs and Funding: historic and anticipated Corps of Engineers expenditures for improvement, operation and maintenance, and studies of the waterways system.

1.2 SCOPE OF THIS REVIEW

The inland waterways system is part of two larger systems. It is treated as a distinct system in this review because the specific waterways involved are similar in the way they function, and unique in the way their improvements are planned and funded. Physically, it is part of a more extensive system of rivers and coastal waterways, of which at least 28,000 miles have been declared navigable and nearly 25,000 miles have been improved to some extent for navigation (Figure 1). Functionally, it is part of our nation's transportation infrastructure, a larger system that includes seagoing vessels and deep draft ports as well as other transportation modes. The waterways system described in this review provides about 11,000 miles of routes for shallow draft commercial vessels, and accounts for over 90 percent of U.S. internal waterborne commerce in terms of tons and ton-miles.

The geographical extent of this waterways system has been determined by the legislation that imposed fuel taxes on vessels using certain waterways. In effect, Congress identified the specific waterways of national interest, and fixed the boundaries of the system. The legislation also provided for improvement of those waterways in two important ways: by creation of the Inland Waterways Trust Fund and use of tax receipts to pay a share of improvement costs, and by exempting system studies from the requirement that non-Federal interests share study costs. As a basis for defining the waterways system, the provisions for system study and improvement are more significant than the taxes in setting the system apart from all other waterways. They provide the means to treat it as a distinct system.

The operation of the inland waterways system is distinguished from other inland waterways by the degree of uniformity in the depth of waterway channels and the sizes of the vessels that use them. Predominantly, system waterways are nine feet deep, with some upper reaches shallower, and some coastal waterways deeper. The dimensions of vessels, locks and waterways are

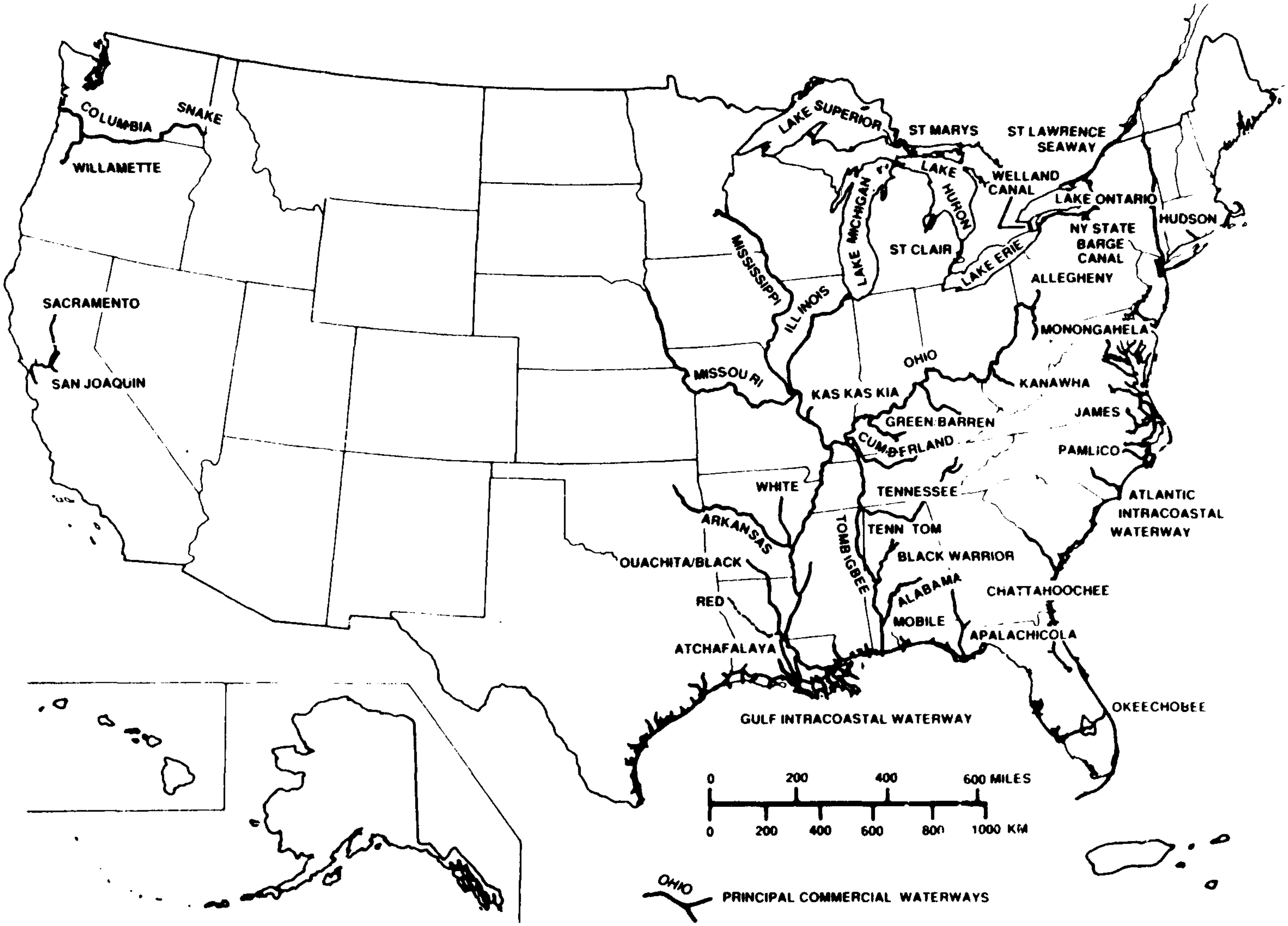

FIGURE 1: THE NAVIGATION SYSTEM OF THE U.S.

interdependent and these components interact as a system. The interaction between vessels, waterways, and cargo facilities determines the efficiency of the system and its ability to carry commerce. For the specific set of waterways involved, the review provides a comprehensive description of the participants and components that determine the performance of the waterways as a system.

The Inland Waterways Revenue Act of 1978 (Pub. L. 95-502) and the Water Resources Development Act of 1986 (Pub. L. 99-662) contain explicit descriptions of the 27 waterways where fuel taxes apply. They are the basis for the waterway system described herein. That system does not coincide exactly with the fuel-taxed portions of the 27 waterways. In some cases, the upper end of a taxed waterway may have local importance only. The waterway segments with little or no commerce are not treated herein as part of the system. Conversely, it is necessary to include certain inland harbors, side channels and waterways that are not taxed when they are integral parts of the system. This system is described in detail in subsequent chapters.

1.3 THE ROLE OF WATERWAYS TRANSPORTATION

Waterways have a unique role in U.S. transportation. Except for the multi-purpose projects that provide benefits such as hydropower and flood protection, commercial navigation is the justification for Federal investment in waterways. All of the waterways in the waterways system have been improved to facilitate transportation of freight and passengers. In many cases, the underlying reason for doing so--and an expressed purpose for improvement of certain rivers--has been economic development. All transportation modes contribute to economic development. What sets waterways apart is their relatively high use and value for purposes other than transportation.

Similar to railroads, waterway traffic is predominantly freight. Freight statistics are readily available, and they are the basis for most evaluations of the waterways. Similar to highways, some waterways have a high level of other public and personal uses. The pools created by dams are sometimes used for water supply purposes. Recreation use is widespread, but not quantified except for isolated statistics such as recreational craft use of locks. There is also a perception that freight statistics understate the value of waterways for defense use, because waterways have a unique ability to handle oversize shipments and to absorb traffic surges due to mobilization or modal shift. In brief, waterway uses include resource as well as economic development, and defense as well as commercial transportation. As a result, the waterways are generally viewed as something more than part of the transportation system.

Measured in terms of ton-miles, the inland waterways system (internal traffic only) provided about nine percent of all U.S. freight transportation in 1990. Comparative ton-miles and traffic shares for the waterways and other transportation modes are presented in Table 1. The percentage of ton miles of traffic carried by waterways and other waterborne transport has held at about 26% of total intercity freight traffic from 1970 to 1990, while actual ton miles has increased by about 36% over that 21 year period.

TABLE 1. DOMESTIC INTERCITY FREIGHT TRAFFIC BY TRANSPORTATION MODE, SELECTED YEARS, 1970-1990

Type of Transport	Ton-Miles (billions) 1970	1980	1989	1990[a]	Percent Distribution 1970	1980	1989	1990
Railroads	771	932	1048	1,071	34.9	31.1	33.0	33.4
Highways	412	555	716	735	18.6	18.5	22.6	22.9
Waterways	156	227	272	283	7.1	7.5	8.6	8.8
Cther Waterborne	439	693	542	527	19.8	23.1	17.1	16.4
Pipelines	431	588	584	583	19.5	19.6	18.4	18.2
Airways	3	5	10	10	0.1	0.2	0.3	0.3
Total	2,212	3,000	3,172	3,209	100.0	100.0	100.0	100.0

Source: Transportation in America Ninth Edition, Supplements, December 1991, Published by ENO Transportation Foundation, Inc.
[a] Estimate

Waterway commerce includes a variety of commodities. Barges can carry up to 3,000 tons, and tows of multiple barges are very fuel efficient. On the Lower Mississippi, a barge tow may consist of 40 barges containing up to 60,000 tons. The largest waterway commodity in terms of both tons and ton-miles is coal. Almost 200 million tons annually, or about 20 percent of all U.S. coal production, moves to domestic markets or are exported via the waterways. Petroleum products are the second largest commodity in terms of tons. Grain is second largest in terms of ton-miles. A high percentage of grain shipments involves long-haul shipments to export points, and the waterway system carries about one-half of U.S. grain exports.

The waterways are ideal for transporting large tonnages over long distances, and over time both total tonnage and ton miles have increased. In 1990, total tonnage of 618 million tons was a record high. Average haul length was about 460 miles in 1989. 1990 data are not available. The overall composition of waterway traffic by commodity is presented in Table 2. The mixture of traffic on specific waterways is described in a subsequent chapter.

TABLE 2. 1990 TONNAGE OF WATERWAY COMMODITIES

Commodity Group	Tons (millions)	Commodity Group	Tons (millions)
Farm Products	79.0	Forest Products	18.8
Metallic Ore/Prod/Scrap	20.5	Industrial Chemicals	31.3
Coal	184.8	Agricultural Chemicals	11.3
Crude Petroleum	50.4	Petroleum Products	118.2
Nonmetallic Min/Prod	76.3	All Other Commodities	11.8
		Total	618.3

Source: Waterborne Commerce of the United States, 1990.

A natural network of river and coastal waterways played a key role in the early settlement of the present United States. In the colonial era, waterway vessels were the dominant form of transportation and, as a result, most of our major population centers are located on or near navigable waters. As a means of transportation, waterway vessels had a compelling advantage in moving goods

and people with the least effort. Over time, the transportation system has developed and matured and all forms of transportation have become much more efficient. Waterway transportation is no longer dominant, but it still has comparative advantage in moving large amounts of freight long distances.

The inland waterways, waterways vessels, and the operation of both, have been improved over time. As in other forms of transportation, efficiency has improved through a combination of technological change and economy of scale. Barge sizes and towboat power have increased, and, more significantly, barge tow sizes have grown. Waterway channels have been improved and lock sizes increased. The route length of the waterways system is essentially unchanged, but the system is used much more intensively. In the past decade, the number of firms involved in vessel operations has been reduced by about one-third. Employment in private industry and the Corps of Engineers associated with waterway operations and maintenance has declined some 12 to 15 percent. The consumption of fuel has declined slightly, based on fuel tax receipts, during a period when waterway traffic grew almost 25 percent.

Use of the waterways is now just one of the transportation alternatives available to most shippers, but it is an integral part of the overall transportation system. It is predominantly intermodal transportation because a high percentage of waterway traffic is interchanged with other transportation modes. For the shippers who can use the waterway system, it provides a low-cost alternative. Waterway transportation ranks at or near the top among transportation modes in terms of ton-miles produced per unit of energy consumed, and the number of employees and man-hours and other resource inputs. It is an important factor in assuring the Nation of a highly competitive and efficient transportation system.

CHAPTER 2
INSTITUTIONAL INFRASTRUCTURE

2.1 INTRODUCTION

A number of different government agencies and private enterprises participate in the operation and management of the waterway system. The purpose of this chapter is to describe their responsibilities and relationships.

The combination of public and private entities that provide waterway transportation has some parallel in the U.S. highway and airways systems. In all three modes, Federal participation is derived from the Commerce clause of the Constitution. The Federal interest in waterborne commerce has been linked to the navigable waters of the United States by tradition and by court decisions defining the Federal power to regulate commerce. The result has been a wide geographical spread of Federal interest in improving harbors and waterways, with that interest narrowly limited to improvements in or directly on the water. The practical effect has been to create a partnership wherein responsibility for the water routes is Federal, and responsibility for providing and operating waterway vessels and port facilities is entirely non-Federal. A significant difference in the Federal interest in waterways, highways and airways applies. Unlike other transportation modes, Federal investment in the waterways is evaluated using the criteria that apply to water resource projects.

2.2 FEDERAL GOVERNMENT

The Federal agencies most directly involved in development and operation of the waterways system are the U.S. Army Corps of Engineers and the U.S. Department of Transportation. The responsibilities of both agencies within the waterways system are part of their broader jurisdictions, that include maritime as well as inland waterway transportation. The basic Corps responsibility is to facilitate the movement of vessels, and it does so by deepening, widening and straightening channels, and regulating river water levels with dams and providing associated locks. As part of its broader jurisdiction it has responsibility for improving inland harbors, side channels and other waterways associated with the inland waterways system, although those improvements are subject to distinctly different cost sharing. The Department of Transportation, through the U.S. Coast Guard, has responsibility for vessel and navigation safety, and provides navigation aids and search and rescue services. The Maritime Administration in the Department of Transportation promotes the development and efficient operation of port facilities and waterway vessels.

Locks and dams provided by the Corps of Engineers are the most important features of the waterways system in terms of investment and impact on how the system operates. The mainstem dams create slackwater pools for more efficient operation of vessels, and minimize channel dredging needs. The dimensions of lock chambers literally shape barge tow configurations, and the dimensions and numbers of lock chambers are the major determinants of system throughput capacity. The Missouri River and the Mississippi River below the locks downstream of the Missouri mouth are the only major system segments without locks. Both of these "open" rivers have extensive river training works, and the Missouri and certain other rivers have water flow augmentation provided by upstream multi-purpose dams. Other system infrastructure provided by the Corps includes ice control structures, bridge protection works, and barge mooring areas needed for reconfiguring barge tows for lock transits.

The Federal government, through the Corps of Engineers, has a key role in planning, building, operating, and maintaining the waterways system because of the massive size of the structures involved and the huge extent of the system. Improvements at any one point on the system affect the volume of traffic to be handled elsewhere in the system, and a central consideration in Corps planning and other waterway activities is the overall efficiency of the system. It is unlikely that the system could be operated by a combination of smaller entities, government or private. The Corps of Engineers has about 2,750 field employees directly involved in lock and waterway operation and maintenance. Planning, engineering, and administration of contract construction and dredging for waterways and other types of Corps civil works projects are performed by about 2,500 employees in field and regional offices and headquarters. Corps expenditures on the waterway system in Fiscal Year 1991 were $528 million for construction and $426 million for operation and maintenance, for a total of $954 million. The cumulative actual cost of waterway system improvements constructed by the Corps is approximately $11 billion. One estimate of current reproduction cost is $40 billion.

2.3 PRIVATE ENTERPRISES

Participation in the costs of maintaining the waterways system is shared by government and the private sector. All of the waterway vessels and cargo terminal facilities needed to produce a useful system are a non-Federal responsibility. All of the vessels are owned and operated by private enterprises. These waterway operators range from individuals with a single towboat to oil, grain, electric utility and transportation companies with fleets of towboats and thousands of barges. Predominantly, the terminal facilities are provided by local private enterprises. In some cases, states and local governments are involved in owning and operating inland river ports.

The ability of private enterprise to provide an adequate supply of terminals and vessels for the waterway system was a matter of concern in the distant past. This does not apply today. The expansion of vessel fleets and port facilities, and their replacement to improve efficiency, are driven by profit opportunity and competitive necessity. As a result, annual rates of expansion and replacement have fluctuated. Within recent memory, the private sector has been able to provide an adequate supply; more than enough in the case of barges.

Maritime Administration studies have identified over 175 inland waterways ports with over 1,500 separate terminals. Corps of Engineers records identify a total of over 40,000 tugs, towboats, and barges that operate on inland and coastal waters. It is estimated that about 35,000 of these vessels operate on the inland waterways system. Private sector investments in waterway vessels and facilities is unknown, but replacement costs have been estimated at $7 to $15 billion for vessels, and $15 billion for facilities. Based on the economic life of vessels and equipment, average annual expenditures to renew the fleet and facilities would be about $550 and $300 million respectively. Revenues, which are about $2 billion per year, must cover amortization, operation and maintenance expenses.

Private sector employment associated with waterways transportation is estimated to be about 175,000. Of that total, about 50,000 individuals are involved in vessel operations, including about 31,000 afloat, 2,250 in vessel management, administration and sales, 5000 in vessel maintenance, repair and construction, 2000 in barge fleeting, 4700 in shoreside terminals plus 500 shore-based tankermen, and about 5000 in miscellaneous support services such as vessel fueling, supplies, surveys and inspection. Contract construction and dredging and other transportation support services account for the remainder.

2.4 STATE AND LOCAL GOVERNMENTS

Historically, the role of state and local governments in the waterways system has been similar to that of the Maritime Administration. They have promoted the development of waterways and inland ports because of their importance to economic development. Direct state investment in the system has been relatively limited. Indiana, Georgia, and Alabama are the only states with state-owned inland ports that are part of the system. Most of the states have encouraged development with enabling legislation for local port authorities. The local authorities are modeled on the authorities in maritime ports, and most non-private investments in inland facilities has been through these local authorities.

The Water Resources Development Act of 1986 will change the traditional role of the states and local authorities because of its requirements for cost sharing of studies and construction of improvements on waterways that are not part of the system subject to fuel tax. There will be a continuing need to develop and improve system tributaries, side channels, and harbors. Some of these may be new projects. Many are existing projects that function as integral parts of the fuel-taxed system, but are not designated for treatment as such. The immediate and practical effect of the new cost sharing is to require the sponsors of such projects to provide about 30 percent of the Federal project costs. The local authorities have had difficulty providing that cost share for the inland harbor and waterway projects that require it. The combined cost of facilities and channel may limit the ability of local sponsors to build new harbors. A broader tax base or a substantial revenue stream from existing facilities is needed. The problem of larger projects that involve multiple political jurisdictions has not been addressed, nor has the role of states in the new cost sharing.

2.5 THE INLAND WATERWAYS USERS BOARD

The Inland Waterways Users Board was created by the Water Resources Development Act of 1986 to give voice to the waterways interests paying waterway fuel taxes. Its 11 members are appointed by the Secretary of the Army, as required by law, to provide a balanced representation of the shippers and carriers using the commercial waterway system. Board members serve without pay. They view the waterway system as a transportation system. Their interest is narrower than that of Congress, which treats the waterways as part of a water resource program, and is concerned with economic development and a need to balance geographical interests.

Congress and the Board have defined the Board's role as stating the priorities and representing the interests of transportation users and providers. This is a new and valuable insight that is not fully integrated into the waterways investment decision process. An overriding concern of commercial waterway operators is to continue improving efficiency. This brings short term rewards and long term survival. The railroads have demonstrated that it is possible to make more money with less system. The waterway operators are interested in more intensive use rather than expansion of the waterway system. Their concern with transportation efficiency can be and has been incorporated into the Corps planning process. The ultimate responsibility and power to balance interests resides in Congress. At that level the impact of the Board is still uncertain.

CHAPTER 3
THE WATERWAYS SYSTEM

3.1 INTRODUCTION

This chapter presents an overview of the fuel taxed waterways system, including the channels and locks, commercial vessel fleet, and the port and dock facilities. More than a half billion tons of commodities are transported through the 216 lock chambers at 167 lock sites on the 11,000 miles of fuel taxed segments on the nation's shallow draft inland and intracoastal waterway system. Most of the channels have depths of 9 to 14 feet. Operators of commercial vessels on fuel tax waterways are subject to the federal inland waterways fuel tax. For summarization purposes the 27 waterways have been aggregated into nine major segments. (Table 3 and Figures 2 and 3).

3.2. PHYSICAL SYSTEM

3.2.1. Channels

The generally north-south oriented Mississippi River and its tributaries are the nation's major inland river transportation network and include the Mississippi, Ohio, Illinois, Arkansas, Tennessee, Missouri and other navigable rivers. These improved navigable channels contain 85 percent of the network's navigable channels with controlling depths of at least 9 feet.

The dominantly east-west oriented Gulf Intracoastal Waterway (GIWW) extends along the coast of the Gulf of Mexico for about 1,100 miles, from St. Marks, Florida, to Brownsville, Texas, on the border with Mexico. Nearly midway along the coast the Mississippi River intersects the GIWW at New Orleans. East of New Orleans the GIWW is intersected by a number of rivers, streams, and channels, including the Mobile River and its tributaries and the Apalachicola-Chattahoochee-Flint System. To the west waterway traffic enters the GIWW from many intersecting waterways, including the GIWW--Morgan City to Port Allen Route, the Atchafalaya River, and the deep draft Houston Ship Channel.

The Mississippi River and its tributaries and the GIWW connect Gulf Coast ports -- such as Mobile, New Orleans, Baton Rouge, Houston, Beaumont, and Corpus Christi, -- with major inland ports -- Memphis, St. Louis, Chicago, Pittsburgh, Cincinnati, Huntington. This major network also provides the operational setting for about 3,200 towboats and 27,500 barges.

The controlling depth of 40 feet in the section of the Mississippi River from Baton Rouge to the Gulf of Mexico allows ocean shipping to join the barge traffic, thereby making this segment vital to both the domestic and foreign trade of the United States.

The Atlantic Intracoastal Waterway is a combination of protected coastal waterways and connecting canal segments which run parallel to the Atlantic Coast between Norfolk, Virginia, and Jacksonville, Florida. Another section known as the Intracoastal Waterway continues from Jacksonville southward to the Florida Keys. A partially protected stretch of the Atlantic Intracoastal Waterway also extends along the Atlantic side of the Delmarva Peninsula and along the coasts of New Jersey and Long Island, NY. Atlantic Coast ports and deep draft channels are connected with areas further inland by other shallow draft waterways that are not very long and serve only a limited area.

TABLE 3. FUEL TAX WATERWAY SEGMENTS, LENGTHS, AND OPERATIONAL LOCKS, 1992

SEGMENT/WATERWAY	LENGTH (MILES)	LOCK SITES	LOCK CHAMBERS NO.	LOCK CHAMBERS AGED[1]
1. UPPER MISSISSIPPI				
Mississippi, Mpls, MN to Mo. R.	663	28	32	27
Subtotal	(663)	(28)	(32)	(27)
2. MIDDLE MISSISSIPPI				
Mississippi, Mo. R. to Ohio R.	195	1	2	0
Kaskaskia River	36	1	1	0
Missouri River, Sioux City to Mouth	735	0	0	0
Subtotal	(966)	(2)	(3)	(0)
3. LOWER MISSISSIPPI				
Mississippi River, Ohio R. to Baton Rouge, LA.	720	0	0	0
McClellan-Kerr Arkansas River	448	17	17	0
White River to Newport, AR	244	0	0	0
Ouachita - Black Rivers	351[2]	4	4	0
Red River to Shreveport, LA	105[2]	3	3	0
Atchafalaya and Old Rivers	121	1	1	0
Subtotal	(1989)	(25)	(25)	(0)
4. ILLINOIS WATERWAY	349	8	8	7
Subtotal	(349)	(8)	(8)	(7)
5. OHIO RIVER SYSTEM				
Ohio River	981	20	40	10
Monongahela River	129	9	13	6
Allegheny River	72	8	8	8
Kanawha River	91[3]	3	6	6
Kentucky River	82[3]	4	4	4
Green River	108[4]	2	2	0
Cumberland River	385[5]	4	4	0
Tennessee	652	9	14	7
Subtotal	(2500)	(59)	(91)	(41)
6. GULF INTRACOASTAL WATERWAY				
GIWW: St. Marks, FL to New Orleans, LA	425[6]	1	1	1
GIWW: N.O. to Brownsville, TX	685[6]	7	9	1
GIWW: Morgan City-Port Allen	64[6]	2	2	0
GIWW: Side Channels	180[7]	0	0	0
Apalachicola, Chattahoochee and Flint Rs.	297[7]	3	3	0
Pearl River	58[8]	3	3	0
Subtotal	(1709)	(16)	(18)	(2)
7. MOBILE RIVER AND TRIBUTARIES				
Mobile, Black Warrior, and Tombigbee Rivers	453	6	6	0
Tennessee-Tombigbee Waterway	234[9]	10	10	0
Alabama River	305[9]	3	3	0
Subtotal	(992)	(19)	(19)	(0)
8. ATLANTIC INTRACOASTAL WATERWAY				
AIWW: Norfolk-Jacksonville, FL	833[10]	3	3	3
IWW: Jacksonville to Miami, FL	370[10]	0	0	0
Subtotal	(1203)	(3)	(3)	(3)
9. COLUMBIA-SNAKE WATERWAY				
Columbia R.: The Dalles to Richland, WA	135[11]	3	3	0
Snake R. to Lewiston, ID	141[11]	4	4	0
Willamette River to Corvallis, OR	26[12]	1	5	5
Subtotal	(302)	(8)	(12)	(5)
TOTAL	10673	168	211	85

NOTE:
1 Chambers built before 1942.
2 Additional 131 miles are fuel taxed but not commercially navigable. However, preconstruction engineering and design and construction are in progress on that section that would increase depth to 9 feet with 3 locks and dams.
3 Depths are 6 feet, but an additional 177 miles are not commercially navigable.
4 Additional 41 miles are fuel taxed but not commercially navigable..
5 There are 71 fewer fuel taxed miles.
6 There are 220 fewer fuel taxed miles for the GIWW.
7 There are 6 fewer fuel taxed miles.
8 Depths are 7 feet.
9 Additional 9 miles are fuel taxed.
10 There are 11 fewer fuel taxed miles for the AIWW and IWW.
11 Additional 91 miles are fuel taxed but not commercially navigable.
12 Additional 133 miles are fuel taxed but not commercially navigable.

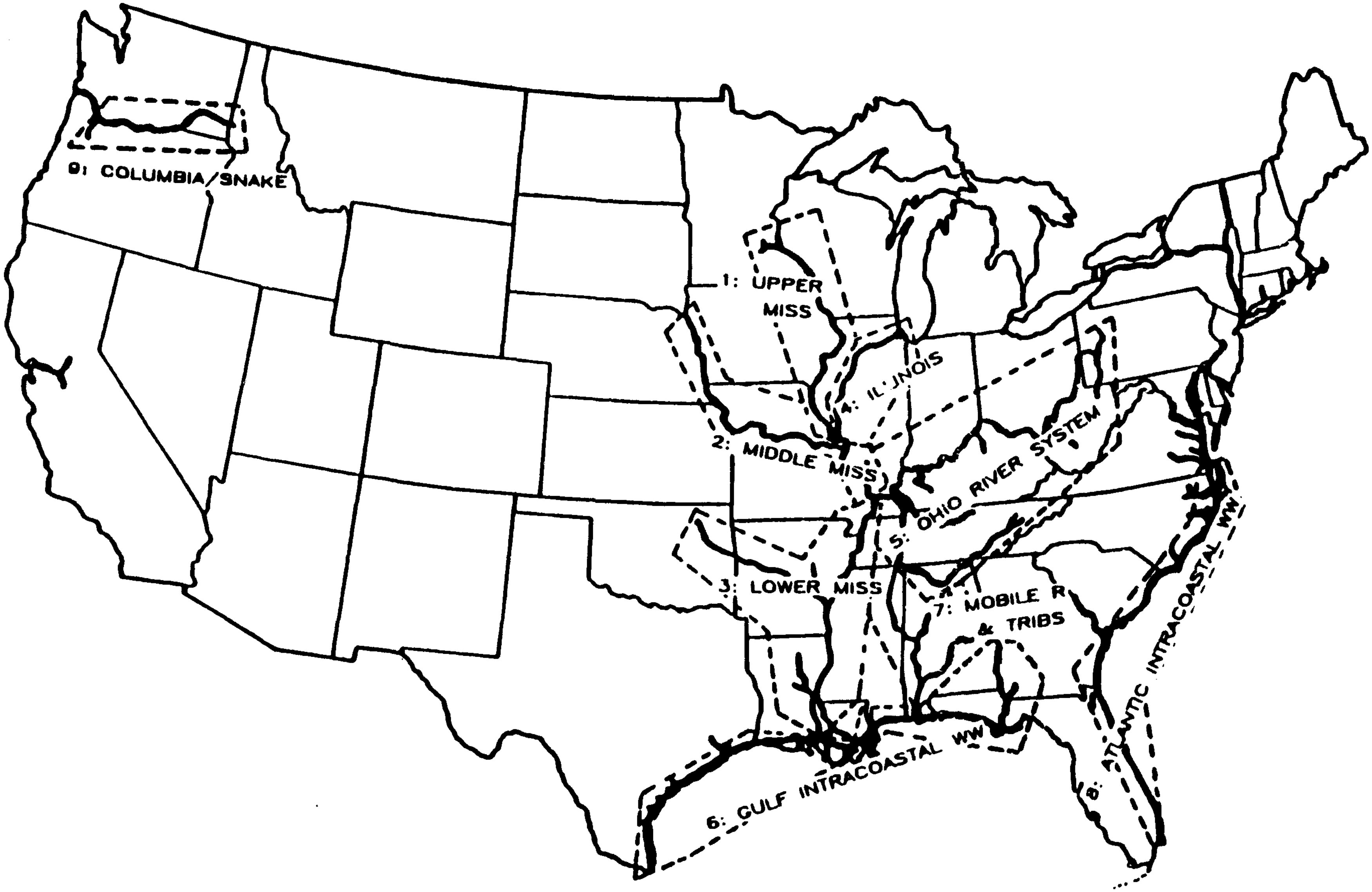

FIGURE 2: INLAND WATERWAYS SEGMENTS

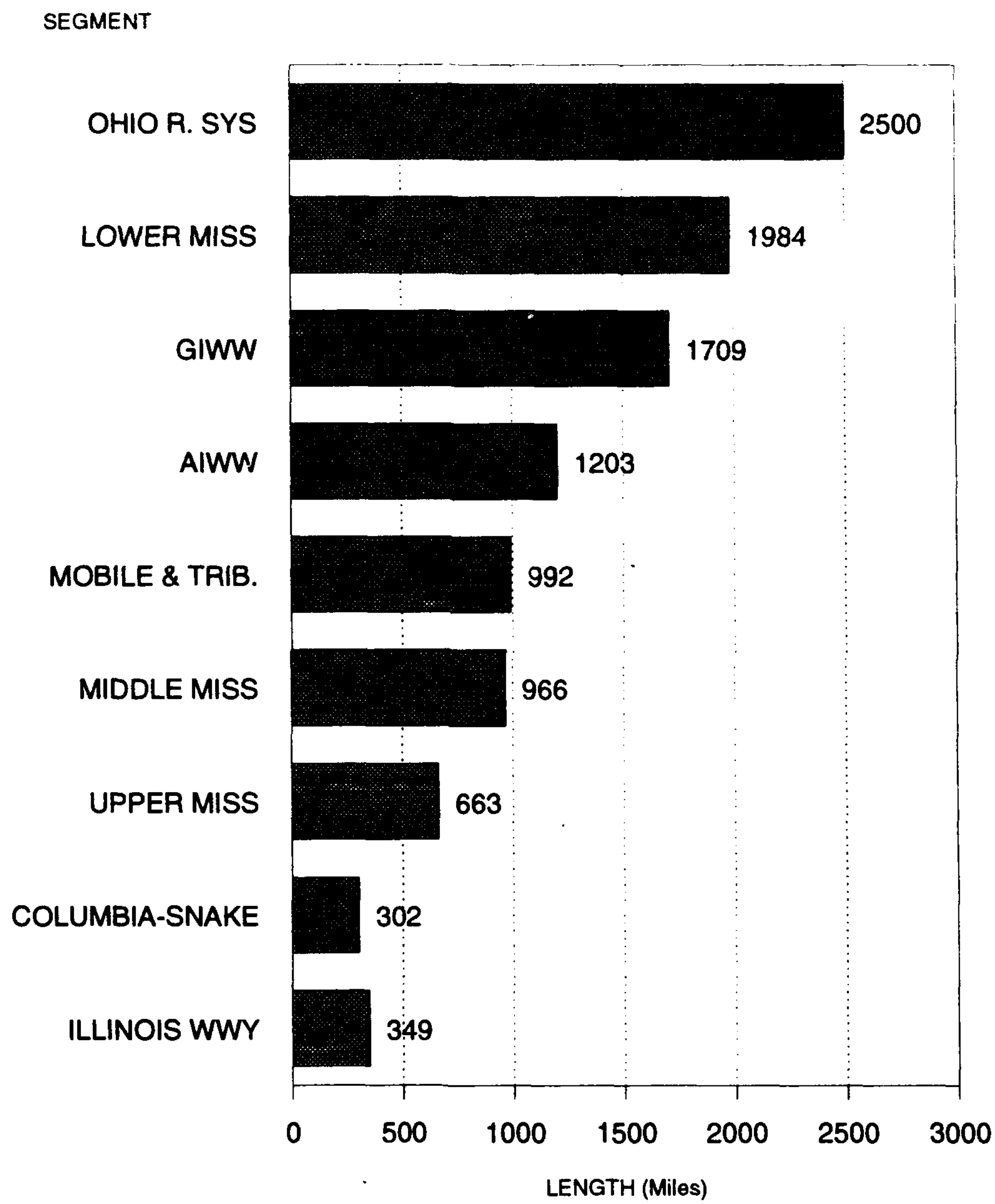

FIGURE 3: INLAND WATERWAYS SYSTEMS SEGMENT LENGTHS (IN MILES)

The shallow-draft inland and coastal waterways of the Pacific Coast include the Columbia-Snake Waterway and the Willamette River above Portland, Oregon; the Sacramento River above Sacramento, California; the San Joaquin River above Stockton, California; and a few short navigable river stretches along the Washington and Oregon coasts. As on the Atlantic Coast, deep draft channels carry most of the waterborne commerce. These channels include the Columbia River below Portland; Puget Sound; the Sacramento and Stockton Deep Draft Ship Channels; and San Francisco Bay.

3.2.2 Lock Characteristics

There are 168 commercially active lock sites with 211 chambers in the nine segments (Table 3). As of 1992, 85 of these lock chambers are aged (over 50 years old). The locks are generally of three lengths. Twenty-five (12 percent) of the lock chambers are 1,000 to 1,200 feet long, 114 (54 percent are 600-999 feet long, and 72 (34 percent) are less than 600 feet long. Widths are mostly 110 feet. Medium and small sized locks are main and auxiliary chambers on the main rivers or single locks on the smaller tributary rivers (Appendix A). The 110 foot wide by 600 or 1200 foot long locks can accommodate a tow made up of 8 to 17 jumbo barges, each measuring 35 feet wide by 195 feet long and having a draft of 9 feet. The lock size and barge size are critical factors in the amount of cargo that can pass through a lock in a given period of time, as will be discussed below.

The current locks range in age from less than a year old at Oliver Lock and Dam on the Black Warrior River to over 150 years old on the Kentucky River. About two-fifths of the chambers are more than 50 years old. The median age of all chambers is about 35 years. Despite the range in age and the number of relatively new lock chambers, there are significant signs of age within the system. Locks on any given waterway tend to be from the same era. Problems that come with aging locks on the waterways tend to affect many locks at the same time.

All but five chambers on the Upper Mississippi were built before 1940. On the Illinois Waterway, all except one lock are over 50 years old. Every lock on the Kanawha River is 50 or more years old. The Allegheny River's youngest lock is 54 years old. Locks with ages of 50 or more years can also be found on the Monongahela, Green, Tennessee/Clinch and Ohio Rivers. The three Atlantic Intracoastal Waterway locks are all over 50 years old. In the Columbia-Snake Waterway segment the Willamette River has five lock chambers, each of which is over 100 years old, and one Columbia River lock is 54 years old.

At the other end of the age distribution is the Tennessee-Tombigbee Waterway, which was placed in operation in 1985. The entire Mobile River and Tributaries Waterway is relatively new, with only three locks over 30 years old.

The Gulf Intracoastal Waterway is a middle-aged system fitting neither the new nor old cohorts described above. Most of its locks range from 26 to 39 years old. For additional data regarding locks see Appendix A.

For the year 2000 the ages of the operating chambers of the major locks on the nine waterway segments are summarized in Table 4 and Figure 4. As indicated, the projection is for 210 lock chambers, a net loss of one from 1992. In the year 2020, 82 of the chambers or 39 percent still will be over 50 years old.

TABLE 4. AGE DISTRIBUTION OF LOCK CHAMBERS IN YEAR 2000 ON FUEL TAX WATERWAYS

RIVER SEGMENT	AGE (YEARS) 0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90	TOTAL
	NUMBER OF CHAMBERS										
UPPER MISS.	2	0	0	1	2	1	25	1	0	0	32
MIDDLE MISS.	0	0	1	0	2	0	0	0	0	0	3
LOWER MISS.	1	4	7	13	0	0	0	0	0	0	25
ILLINOIS	0	0	0	1	0	0	7	0	0	0	8
OHIO	7	3	13	17	12	3	18	11	0	6	90
GIWW	0	1	0	3	12	0	1	1	0	0	18
MOBILE	1	8	4	4	2	0	0	0	0	0	19
AIWW	0	0	0	0	0	2	1	0	0	0	3
C-S-W	0	0	2	3	2	0	0	0	0	5	12
TOTAL	11	16	27	42	32	6	52	13	0	11	210

NOTE: Assumes replacements of single locks at Grays Landing and Point Marion on the Monongahela River, an additional lock at Winfield on the Kanawha River, and replacement of Locks and Dams 52 and 53 by Olmsted Locks and Dam on the Ohio River by 2000 as scheduled. Excludes two existing chambers that are not operational.

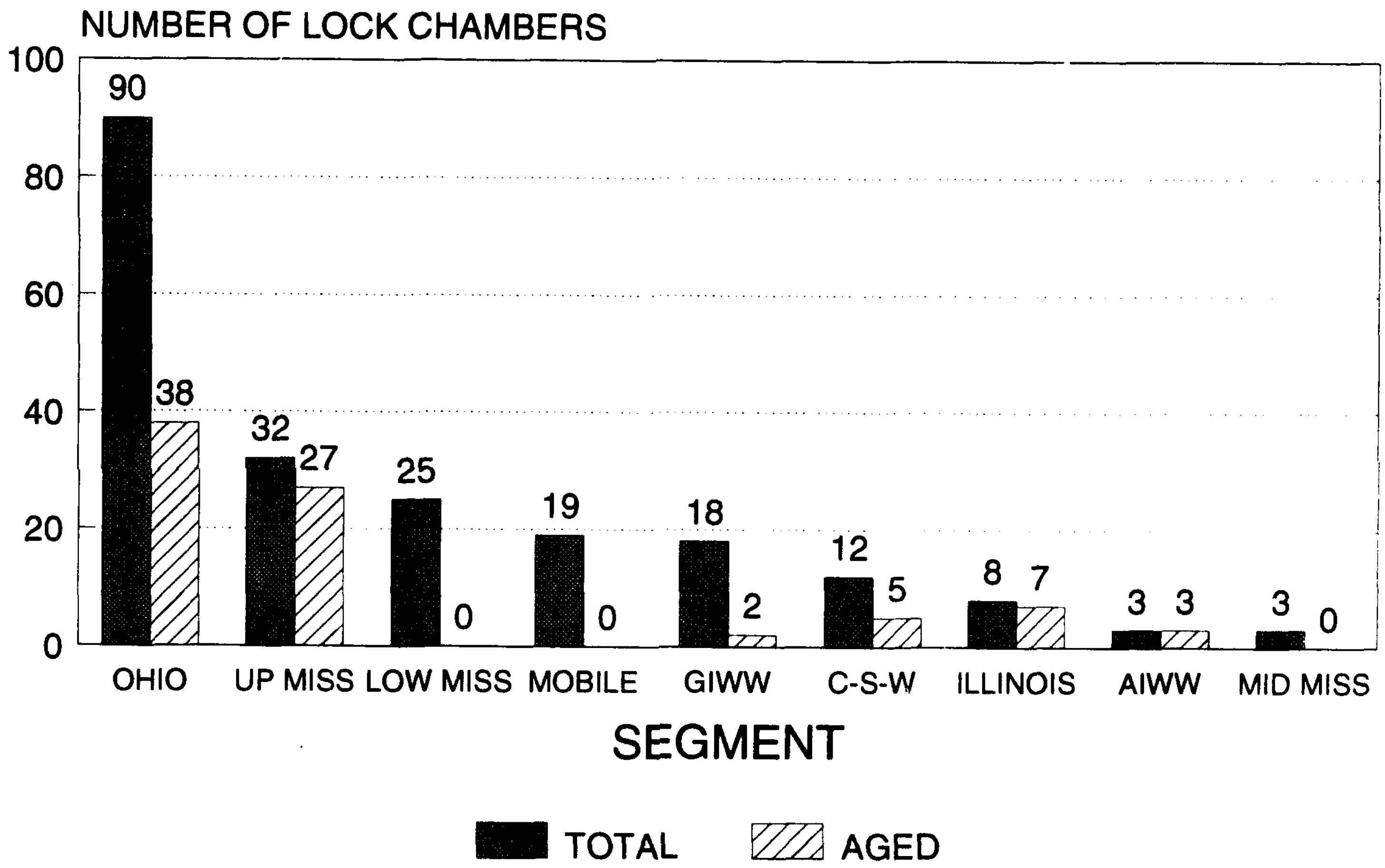

FIGURE 4: TOTAL AND AGED (>50 YEARS OLD)
LOCK CHAMBERS IN THE YEAR 2000

3.2.3 Lock Performance

a. Introduction

For the commercial waterway operator, the time a tow spends underway in channels converts directly to ton-miles. The time spent at locks is expense, regardless of whether it is waiting, lock processing, or downtime. Delay costs are in the range of $300 to $400 per hour, based on a 15 barge tow pushed by a 2,200 to 4,400 horsepower towboat. The time and related expense is a prime concern of the vessel operator.

It is important to identify priorities for improvements to the inland waterways system. Delay time and lock processing time can give some indication of the benefits foregone by delaying improvement projects.

Comparing the performance of interacting locks to determine the problems and needs of the waterway system is a focus of this Review. Numerous lock performance indicators can be used for this purpose, such as tonnage, capacity, delay time, processing time, and downtime or stall frequency and duration. An extreme value for one of these indicators is often evidence that a problem exists or may be developing. However, no one indicator is conclusive. Rankings of locks based on various indicators may include the same projects, but rarely in the same rank order. The highest ranked projects for one indicator may not be the same as those for another indicator. Individual rankings may require qualification.

The identification of problem locks is a preliminary to more useful analyses. Performance indicators can be used to determine the direction of Corps planning efforts, and ultimately that process can provide definitive analyses for investment decisions. They can also provide a preliminary way to measure and predict the impact of the problem. Certain "problem" locks with extreme values have a significant effect on the averages.

This section presents some lock performance indicators to examine 1990 lock activity for the locks on the fuel taxed waterways and to present some basic relationships for the years 1980 through 1989. These data provide some indication of the significance of problems on the system.

A consolidated listing of the locks showing certain key indicators for 1990 is in Appendix B. The indicators have been used to produce rankings of the locks based on time utilization, average delay, and recreational use (Tables 5, 6, 7 and 8). The table ranking locks with highest average delay also shows data at those locks for the related indicators of total delay time, average processing time, total down (stall) time, total stall events, and lock traffic. The text discusses the 1990 performance for some of these other indicators, but no separate tables are provided.

Complete data for 1990 were available for 1980locks. The rankings of locks based on key indicators, particularly average delay and time utilization, are presented to identify "problem locks" and to provide a reference for the discussion of the Corps waterways improvement program.

b. Utilization

The capacity of a lock depends on many variables. Capacity is an estimate of the maximum number of tons of cargo of a specified mix that may transit a lock in a given period of time under a specific set of assumptions. The difference between high and low capacity estimates can be substantial, depending on assumptions about the level and type of future traffic, vessel operating practices, and lock operating conditions. The low capacity estimate is used in this Review.

TABLE 5: LOCKS WITH TIME UTILIZATION OF AT LEAST 60 PERCENT IN 1990

LOCK NAME	LOCK TIME UTIL. (RANK)	LOCK TIME UTIL. (%)(1)	LOCK CAPACITY UTIL. (%)(2)	LOCK TRAFFIC (MILLIONS OF TONS)	EST. LOCK CAPACITY (MILLIONS OF TONS)
INNER HARBOR (GIWW)	1	92.9	83.6	23.4	28
ALGIERS (GIWW)	2	88.3	68.9	24.8	36
L&D 17 (UPPER MISS)	3	81.2	82.9	37.3	45
L&D 18 (UPPER MISS)	4	79.9	75.4	37.7	50
KENTUCKY (TENNESSEE)	5	78.8	74.1	28.9	39
L&D 16 (UPPER MISS)	6	77.0	69.6	34.1	49
CALCASIEU (GIWW)	7	76.2	67.1	46.3	69
*BONNEVILLE (COLUMBIA)(3)	8	75.2	63.3	7.6	12
PORT ALLEN (GIWW)	9	73.6	54.1	7.6	51
L&D 24 (UPPER MISS.)	10	73.3	92.2	42.4	46
L&D 22 (UPPER MISS)	11	73.2	92.0	41.4	45
LELAND BOWMAN (GIWW)	12	72.4	61.2	45.9	75
BAYOU SORREL (GIWW)	13	71.7	86.5	37.2	43
L&D 25 (UPPER MISS.)	14	69.7	88.1	42.3	48
BAYOU BOEUF (GIWW)	15	65.4	78.9	27.6	35
L&D 11 (UPPER MISS)	16	66.2	56.7	20.4	36
L&D 21 (UPPER MISS)	17	65.5	83.3	40.8	49
L&D 20 (UPPER MISS)	18	65.3	84.7	39.8	47
TROY (HUDSON R.)(3)	19	63.9	NA	0.2	NA
L&D 13 (UPPER MISS)	20	63.1	56.2	25.3	45
L&D 7 (MONON)	21	61.7	78.8	12.6	16
L&D 3 (UPPER MISS)	22	61.2	38.1	14.1	37
L&D 2 (UPPER MISS)	23	61.0	39.4	14.2	36
L&D 7 (UPPER MISS)	24	60.9	34.7	17.0	49
L&D 8 (UPPER MISS)	25	60.1	35.7	17.5	49
L&D 6 (UPPER MISS)	26	59.9	34.7	17.0	49
L&D 10 (UPPER MISS)	27	59.8	43.5	20.9	48
MARSEILLES (ILLINOIS)	28	59.8	56.6	21.5	38
TIME UTILIZATION AVERAGE (198 LOCKS)		38.9			

NOTES: (1) Lock time utilization based on main chamber if multiple chamber lock.
(2) Lock capacity utilization = lock traffic / est. lock capacity
(3) Not on fuel taxed inland waterways.
* No data available for January and May 1990.

TABLE 6: LOCKS WITH TIME UTILIZATION RATE OF AT LEAST 60% IN 1990 AND 1980-1989 PEAK YEAR AMOUNT

LOCK (WATERWAY)	1990 RANK	1990 TIME UTIL. (%)(1)	1980-89 PEAK (%)	1980-89 PEAK YEAR
INNER HARBOR (GIWW)	1	92.9	100.0	87
ALGIERS (GIWW)	2	88.3	92.5	89
L&D 16 (UPPER MISS)	3	88.3	74.6	89
L&D 17 (UPPER MISS)	4	81.2	73.0	89
L&D 18 (UPPER MISS)	5	79.9	69.0	83
KENTUCKY (TENNESSEE)	6	78.8	86.0	87
CALCASIEU (GIWW)	7	76.2	81.4	89
HARVEY (GIWW)	8	75.6	65.0	82
*BONNEVILLE (COLUMBIA)(2)	9	75.2	73.5	88
PORT ALLEN (GIWW)	10	73.6	77.0	84
L&D 24 (UPPER MISS.)	11	73.3	69.0	83
L&D 22 (UPPER MISS)	12	73.2	85.0	89
LELAND BOWMAN (GIWW)	13	72.4	67.0	85
BAYOU SORREL (GIWW)	14	71.7	74.5	89
L&D 25 (UPPER MISS.)	15	69.7	65.1	89
BAYOU BOEUF (GIWW)	16	66.4	76.0	82
L&D 11 (UPPER MISS)	17	66.2	63.3	89
L&D 21 (UPPER MISS)	18	65.5	77.7	89
L&D 20 (UPPER MISS)	19	65.3	81.1	89
TROY (HUDSON R.)(2)	20	63.9	NA	NA
L&D 13 (UPPER MISS)	21	63.1	62.2	89
L&D 7 (MONON)	22	61.7	62.6	89
L&D 3 (UPPER MISS)	23	61.2	60.0	86
L&D 2 (UPPER MISS)	24	61.0	95.7	89
L&D 7 (UPPER MISS)	25	60.9	60.0	86
L&D 8 (UPPER MISS)	26	60.1	60.0	86
L&D 6 (UPPER MISS)	27	59.9	59.0	86
L&D 10 (UPPER MISS)	28	59.8	58.0	86
MARSEILLES (ILLINOIS)	29	59.8	65.0	82
UTILIZATION AVERAGE (198 LOCKS)		38.9		

NOTES: (1) Lock time utilization based on main chamber if multiple chamber lock.
(2) Not on fuel taxed inland waterways.
* No data available for January and May 1991.

TABLE 7. LOCKS WITH AVERAGE DELAY OF AT LEAST ONE HOUR IN 1990

LOCK (WATERWAY)	AVERAGE DELAY (RANK)	AVERAGE DELAY TIME PER VESSEL (HRS)(1)	AVERAGE PROCESS TIME (HRS)(2)	TOTAL DELAY TIME (HRS)(3)	TOTAL STALL TIME (HRS)	TOTAL NO. OF STALL EVENTS	LOCK TIME UTIL (%)(4)	LOCK TRAFFIC (MILLIONS) OF TONS)
INNER HARBOR (GIWW)	1	8.5	9.2	148374	2397.6	229	93	23.4
L&D 20 (UPPER MISS)	2	4.1	5.3	18954	960.7	87	65	39.8
L&D 24 (UPPER MISS)	3	4.0	5.1	22687	183.4	391	73	42.4
L&D 22 (UPPER MISS)	4	3.6	4.8	18556	285.0	83	73	41.4
BAYOU SORREL (GIWW)	5	3.0	3.9	28089	289.0	72	72	37.2
L&D 17 (UPPER MISS)	6	3.0	4.2	12721	85.6	48	81	37.3
ALGIERS (GIWW)	7	2.8	3.8	40438	91.5	41	88	24.8
KENTUCKY (TENNESSEE)	8	2.4	3.6	12089	185.7	321	79	28.9
L&D 25 (UPPER MISS)	9	2.1	2.9	14312	175.0	204	70	42.3
L&D 18 (UPPER MISS)	10	2.0	3.0	10228	79.9	97	80	37.7
PORT ALLEN (GIWW)	11	1.8	3.1	32719	16532.5	5151	74	27.6
L&D 21 (UPPER MISS)	12	1.7	2.7	8748	302.3	77	65	40.8
HARVEY (GIWW)	13	1.3	1.9	12621	529.9	301	51	3.6
*BONNEVILLE (COLUMBIA)(5)	14	1.1	1.2	2507	26.3	11	75	7.6
LAGRANGE (ILLINOIS)	15	1.3	1.8	5292	67.2	37	26	36.0
L&D 16 (UPPER MISS)	16	1.3	1.7	6522	102.7	78	77	34.1
FORT LOUDON (TENNESSEE)	17	1.1	1.6	717	1987.2	269	25	0.6
CALCASIEU (GIWW)	18	1.1	1.7	19273	1204.9	518	76	46.3
AVERAGE DELAY AVERAGE (198 LOCKS)		.94						

NOTES:
(1) Average delay time = (wait time + stall time) / no. of vessels.
(2) Average process time = (wait time + approach time + entry time + chamber time + exit time + turnback time + stall time) / no. of vessels.
(3) Commercial vessels only. Due to overlapping time between vessels, there may be more delay than the number of hours in a year.
(4) Lock time utilization based on main chamber if multiple chamber lock.
(5) Not on fuel taxed system.
* No data available for January and May 1991.

Although lock time utilization and capacity utilization measures are not identical, the two generally can be expected to correlate closely. Either measure has certain limitations. Lock capacity utilization estimates are dependent on several assumed variables, while time utilization rates reflect the actual mix of traffic, existing conditions, and other variables. The unutilized or idle time can be a good indication of residual capacity. However, the utilization rate as used herein does not distinguish between processing time and stall time. A high time utilization rate may reflect high traffic levels or excessive stall or downtime. It implies a lock is approaching capacity, but it may be due to operating problems that can be cured without replacement.

Lock time utilization normally accounts for operation or lockage time only. Utilization time is a derived number based on the total operating time. The lock time utilization rate is the percentage produced by dividing total operating time (vessel and lock processing time and open pass operation) by the total time in the reporting period.

However, for this Review a unique combination is used that accounts for downtime or stall time also, and gives an indication of residual capacity. The number was derived by subtracting idle time from total available time. Lock time utilization in this Review is total time less idle time, thus combining operating and stall time.

In 1990 the time utilization rates at three main chamber locks were 80 to 100 percent, while 22 more locks had utilization levels of 60 to 79 percent (Table 5). These locks include nearly all ten locks authorized for replacement in 1978, 1986, and 1988. Most of the others are under study for additional or replacement lock chambers and many have undergone major rehabilitation. Considering all 198 locks for which 1990 LPMS data are available, 12 chambers had between 80 to 100 percent time utilization, 36 had between 60 to 79 percent time utilization, and 35 chambers had time utilization between 40 to 59 percent. Some of these also are under study for possible improvements because of anticipated congestion and delays after the turn of the century, as traffic increases and utilization exceeds 60 percent. Time utilization is low to moderate (20 to 39 percent) at 45 locks and low (0 to 19 percent) at 70 lock chambers (Figure 5).

A closer look at the main chamber locks with time utilization of at least 60 percent in 1990 shows that 16 are on the Mississippi River from Lock and Dam 25, north of St. Louis to Lock and Dam 1 near St. Paul, Minnesota (Table 5). Seven GIWW locks already have high or moderately high utilization of 60 percent or higher. Two locks in the Ohio River system and one lock each on the Columbia River and Illinois Waterway are also in this group.

A comparison of time and capacity utilization for the 28 locks with at least 60 percent time utilization in 1990 shows strong correlation (Figure 6 and Table 5). For two-thirds of these locks time utilization was greater than capacity utilization. Time and capacity utilization exceeded 70 percent at 13 and 12 locks respectively. While time utilization for 15 locks ranged from 60 to 70 percent, capacity utilization for 15 locks ranged more widely from 35 to 70 percent.

As inland waterways traffic has steadily climbed from its recession lows in 1982 and 1983, lock utilization has also increased. For the locks with time utilization of at least 60 percent in 1990, the rate in 1990 equaled or exceeded the peak rate in the previous nine years at half of the locks. (Figure 7 and Table 6).

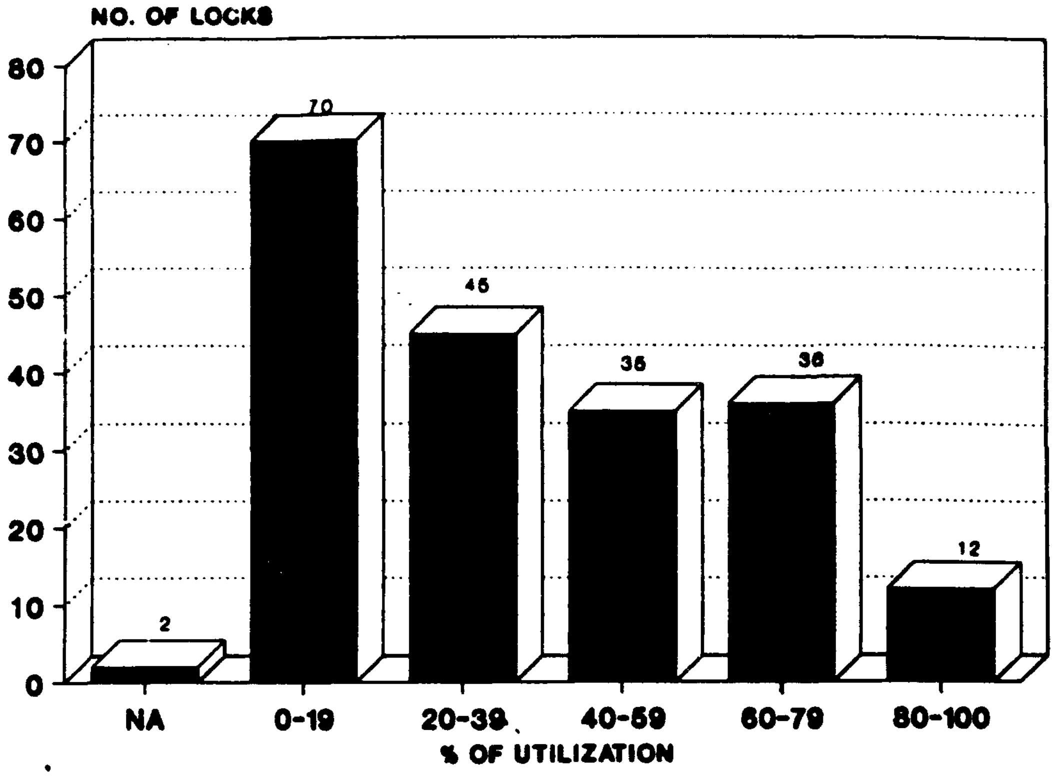

FIGURE 5: LOCK TIME UTILIZATION IN 1990

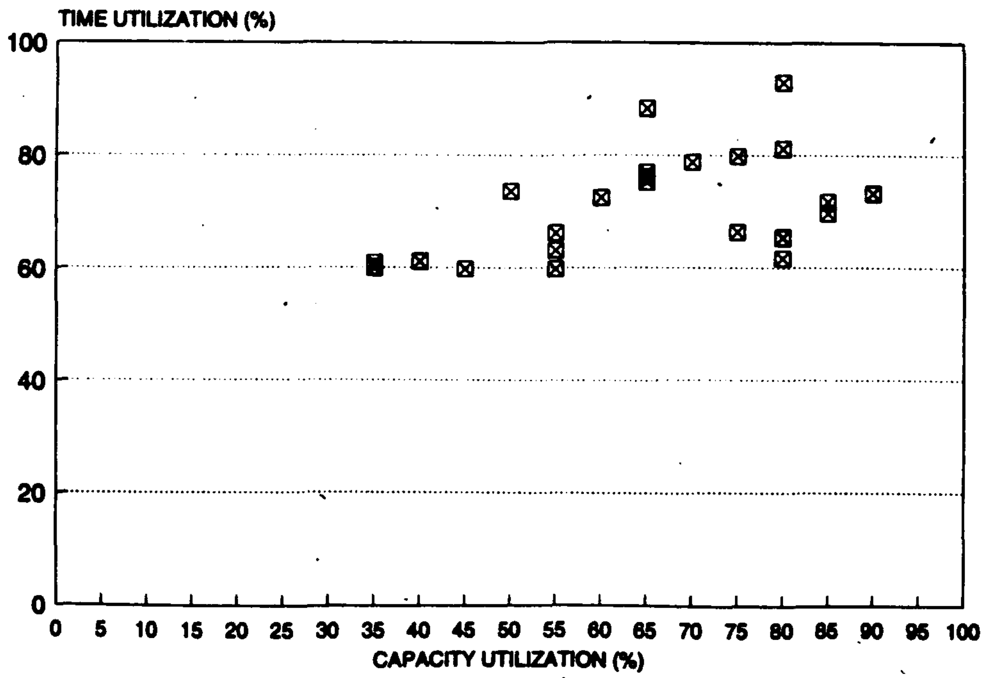

FIGURE 6: LOCKS WITH TIME UTILIZATION OF AT LEAST 60% & THEIR CAPACITY UTILIZED IN 1990

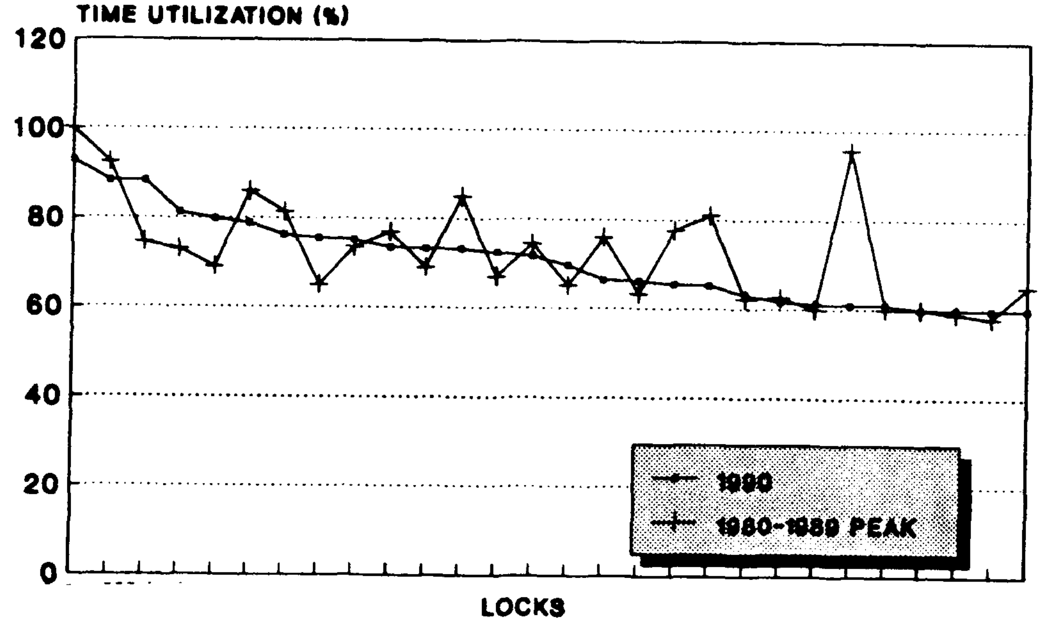

FIGURE 7: LOCKS WITH TIME UTILIZATION OF AT LEAST 60% IN 1990 & 1980-1989 PEAK YEAR

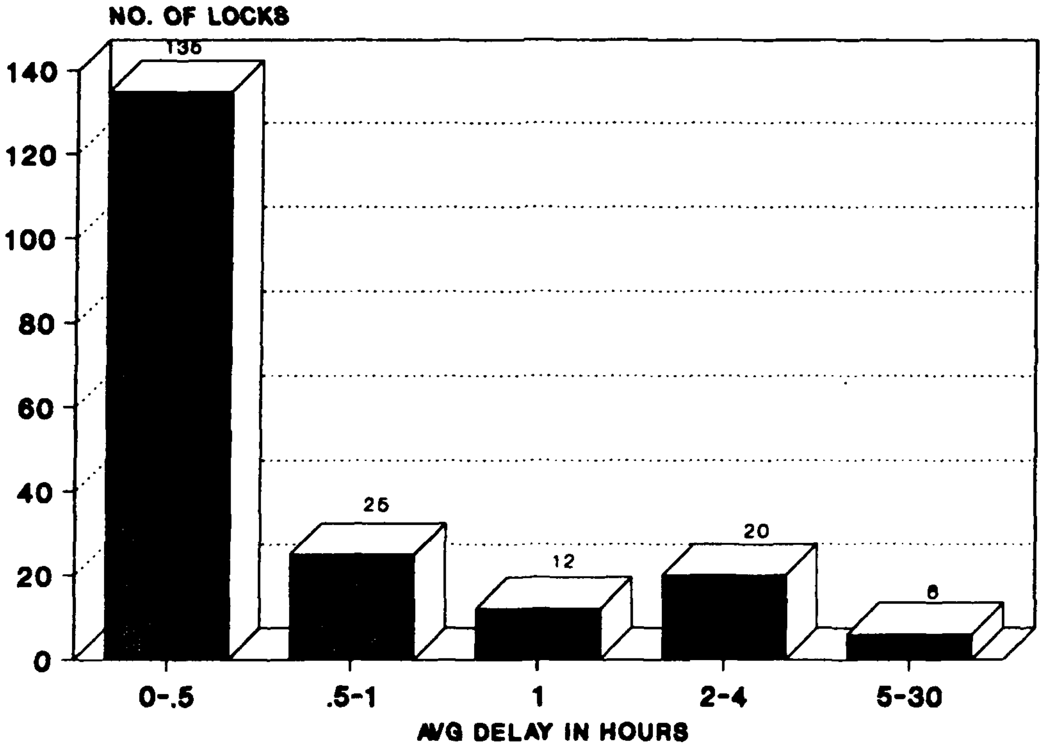

FIGURE 8: LOCK AVERAGE DELAY IN 1990

c. Delay

Delay or wait time is the time elapsed from the arrival of a tow or single vessel at a lock to the start of its approach to a lock chamber. Delay time for a queue of vessels or tows is the cumulative total for all vessels and tows waiting.

However, delay time in this Review is the combination of wait and stall time. Delay time is shown as both average time and total time in the lock-specific statistics. Wait time reflects queuing, which depends on the level of traffic and lock capacity. Stall time represents interruptions due to lock and other conditions. Individually and collectively these times vary more than lockage time at any one lock. Collectively they can be considered non-productive time by the vessel operator. For that reason and economy of analysis, they are combined in the Review's analyses.

The average delay times are based on total delay hours divided by the total number of discrete tows and single vessels processed at the various locks. An alternate measure of delay is to divide total delay only by the number of vessels and tows that actually experienced delay. In most cases the alternate calculation will produce a higher average delay.

In 1990 the average delay at locks was three hours or more at six locks, of which three experienced average delays of four or more hours (Table 7). There was an average delay of 2.0 to 2.9 hours at four locks and of 1.1 to 1.9 hours at eight locks. The average delay average for 198 locks was 0.94 hours. Eight of the locks with average delays of an hour or more were on the Upper Mississippi River. Six locks with significant delays were located on the Gulf Intracoastal Waterway and four were on other waterways, including the Columbia (1), Illinois (1), and the Tennessee (2). Corrective action in the form of construction, rehabilitation, or study is being or has been taken on nearly all the locks. Twenty-five locks have moderate average delays of 30 to 60 minutes while 135 locks have slight delays averaging only 0 to 29 minutes (Figure 8).

For those locks with time utilization of at least 60 percent there was a moderate correlation with average delay time (Figure 9). Most of the locks exhibited average delays of .5 to 3 hours, and their utilization ranged mostly between 60 and 80 percent. As traffic increases in the next eighteen years at the locks with moderate time utilization (40 to 59 percent), those with moderate average delays of 30 to 60 minutes can expect delays to reach one or two hours as utilization reaches 60 to 80 percent.

At four locks the total delay time for 1990 was 1000 to 6,200 days. At 13 other locks the total delay time ranged from 100 to 1000 days (Table 7). Note that delay time can be greater than the number of days in a year because of the combined delay times among vessels. Of the six locks with average delays exceeding three hours there were five whose total delay exceeded 750 days.

The hypothesis that wait time will increase exponentially as a lock approaches capacity is supported by 1980-89 data, which indicates the relationship is lock specific and dependent on variable conditions. The relationships derived using an average lock or peak 1980-89 lock data are general; the precise relationship will change as conditions change.

The relationship between annual delay time and the percentage of lock time utilization for the average lock for 1980-89 shows delay time can be expected to increase as the percentage of utilization increases. The relationships

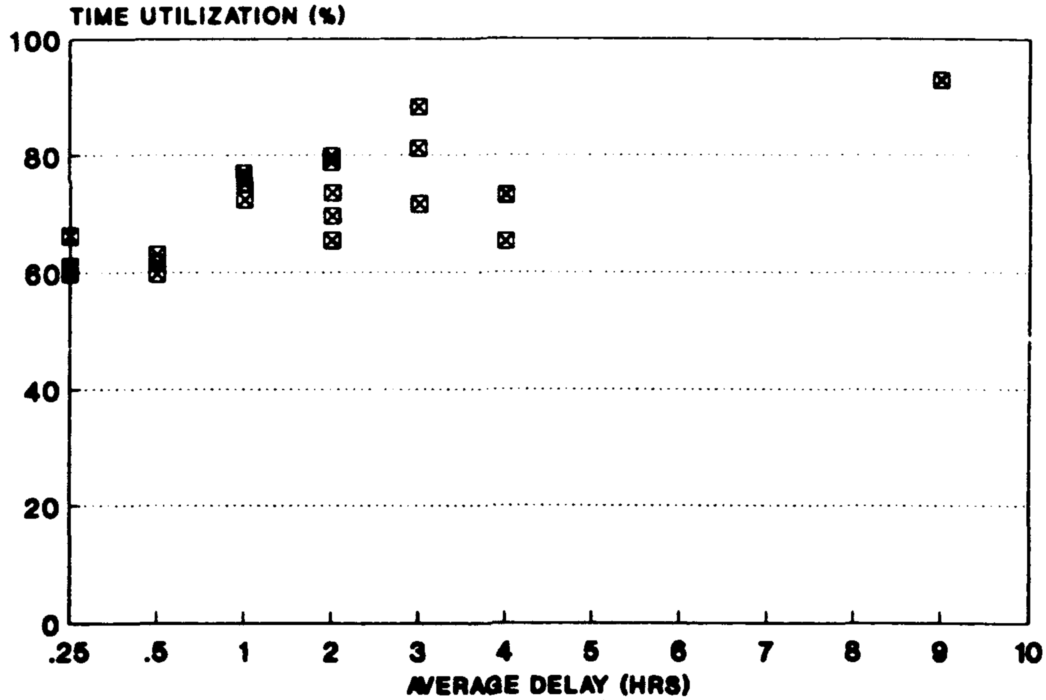

FIGURE 9: LOCKS WITH TIME UTILIZATION OF AT LEAST 60% & THEIR AVG DELAY IN 1990

represent an average for the entire system rather than the actual delay for any one lock. Specific locks with a given percentage of utilization may have more or less delay.

The relationship provides two specific pieces of useful information. First, an estimate of the actual delay time associated with a level of utilization can be obtained. Second, the slope of the graphed lines reveals how much delay increases for an incremental increase in utilization.

Analysis also shows that "natural" levels of delay at zero or low levels of lock utilization range from 0 to 2,500 hours per lock on average. At full utilization levels the range in delay is from about 5,500 hours to 13,000 hours per lock. In general, an individual lock that has more delay at a given percentage of utilization than the average is performing worse than a lock with less than average delay.

The analysis also provides a single benchmark for summarizing system performance in terms of delay and time utilization by isolating the peak year values. The relationship is based on the delay observed during each lock's highest utilization percentage in the 1980s. A one percent increase in utilization for an average lock during the 1980s resulted in an additional 109 hours of delay per lock. A ten percent increase in utilization resulted in 1,090 hours of delay, etc.

To the extent that percentage of time utilization reflects trends in percentage of capacity utilization, the costs of delay can increase significantly as a lock approaches capacity operation. The cumulative costs add up rapidly over time. Delay costs could be much worse at problem locks than for average relationships of all locks on the waterway system.

d. Processing Time

Available time is the amount of time in a reporting period that a lock chamber is in service, either operating or idle. It excludes all stall time. Idle time is the interval between lockages when the lock or chamber is available for service.

A lockage is the series of events required to transfer a vessel or tow with all its barges through a lock in a single direction. More than one vessel can be processed during one lockage, and a tow may require several cycles to be completely processed. Lockage is normally defined as processing time. It is an indicator of the technological obsolescence of a lock, in that an older, less efficient lock would take longer for a hardware cycle than when new. Extreme values may indicate lock dimensions are no longer adequate for current tow configurations. For any one lock this time is relatively constant because it depends on lock machinery and the number of cycles required to process the tows usually handled. Lock reliability is reflected in stall or downtime, and except to focus on those factors, lockage is not otherwise analyzed in this Review.

Processing time is normally the time to completely process a vessel through a lock, from start of lockage to end of lockage. It is composed of lock processing time which is dependent on lock operation, and vessel processing time, which is dependent on vessel operation. Transit time is the time required for a vessel to transit a lock including waiting or delay time and processing time excluding stalls.

However, processing time in this Review is the combination of wait, stall, and processing time. Processing time is a unique term as used herein, for a unique combination of lockage or lock processing time and a combination of wait and stall time called "delay time." It represents the total time spent by a vessel or tow at a lock, and is shown as average processing time for

individual locks. This total accounts for vessel time, and has some usefulness in screening to identify problem locks. Inspection of its component parts is needed to identify the reasons for variation.

In 1990 the average processing time for main chamber locks was about 5 to 10 hours at four locks and one to four hours at 14 other locks. At the six locks with average delays exceeding three hours the average processing time exceeded three hours, but four other locks also had average processing times of three hours or more.

e. Downtime (Stalls)

All time at a lock chamber is normally divided into three basic categories: utilization or operating time, idle time, and down or stall time. A stall is an occurrence which stops lock operation. Stalls during idle time are still accounted for as stalls. They are expressed in both total annual time (days) and number of occurrences for each lock (Table 7).

The causes of stalls have been grouped into three categories: lock conditions, natural conditions, and tow and other conditions. Lock condition stalls occur because of equipment malfunction, testing and maintenance, debris in the chamber, or unavailable lock personnel. The frequency and duration of these types of stalls are, in theory, correctable. Rehabilitation or replacement of a lock with much lock-related downtime would presumably result in less equipment malfunction and less need for testing and maintenance.

Natural condition stalls include weather and water surface conditions. These stalls for the most part cannot be affected by lock improvements. However, there are cases where an improved approach wall alignment or other structural change could mitigate the effect of some natural conditions. Tow and other conditions that can cause stalls include tow malfunction or interference, collisions or accidents, and other unspecified causes. These causes are also generally less subject to control through policy choices.

Lock performance can be affected by two dimensions of the downtime problem. First, the frequency with which a lock is out of service is important to users. To measure this dimension we use the number of stall events regardless of their duration. The second dimension is the duration of a stall. Very long stalls allow shippers the option of shipping by other modes if the stall is anticipated, such as scheduled maintenance, or its duration can be reasonably forecast, such as a flood or ice jam. Very short duration stalls may be little more than a nuisance. The total downtime per year is used as a measure of the duration of stall events.

In 1990 Port Allen Lock had total stall time (downtime) of almost 700 days and a time utilization of 74 percent. The total stall time at three locks was 50 to 100 days while at fourteen other locks it was 1 to 40 days. At the 12 locks whose delay time exceeded 450 days there were only three locks with total stall time greater than 50 days (Table 7).

Port Allen Lock reported over 5000 stall events and seven other main chamber locks recorded 200 to over 500 stalls in 1990 (Table 7). Ten locks experienced under 100 stalls. Five of the six locks with total stall time greater than 15 days also saw over 200 stalls during the year. There has been no nationwide analysis of stalls and stall time in terms of lock, natural, and tow and other conditions.

In summary, this Review's analysis of 1980-90 data shows that the frequency of stall occurrences contributes more to delay than does the duration of the stall. Based on the preceding analysis, a one percent reduction in lock time utilization or downtime will save about 109 hours of delay time. Improvement in lock reliability (i.e., fewer and shorter stalls)

effected through rehabilitation and maintenance programs, can reduce delay time significantly; 110 hours per stall event and 11 hours per stall hour, based on the 1980s data. These estimates are for average situations. It must be kept in mind that specific locks may have circumstances significantly different from the average.

The relationship between delay time and the number of stalls for a typical lock shows that delay time increases with the number of stalls. Because most stall occurrences are subject to chance and little advance notice can be given to towboat captains, it is reasonable to expect that vessel trip time would be affected. If stall occurrences were well known, schedules could be adjusted to eliminate or at least minimize their effects.

"Natural" levels of delay observed with no stalls are consistent with those shown in the section above through the 1980s. At a level of 400 stalls per year delay ranges from 36,000 to 57,000 hours on average. Few locks have experienced such large numbers of delays and this figure is more relevant in the range from 0 to 100 stalls. In a graph of the number of stalls and total delay the slopes of the lines provide some useful information. In the 1980s one additional stall event caused about 120 hours of additional delay on average.

The relationship between the number of stalls and delay time for the peak years of each lock during the 1980s indicates that on average one more stall caused about 110 more hours of delay time on average.

The relationship between the annual duration of stalls and delay during the 1980s is inconclusive. The peak year relationship between duration of stall and delay shows one more hour of stall time resulted in an additional 11 hours of delay.

f. <u>Recreational Use</u>

Recreational use of waterways is generally compatible with commercial navigation. It is concentrated in the summer months, particularly during daylight hours on weekends and holidays. Any competition in use is likely to be at locks when queuing occurs. Because the recreation craft are fragile compared to commercial vessels, separate lockages are usually required, and there are in effect two queues. Because of the growing number of recreational craft and their increasing use for cruising instead of sedentary fishing, their competition with tows for lock use is expected to increase. Problems from this competition is greater at single chamber locks, which are generally found outside the Ohio River system, since there isn't a smaller auxiliary chamber to handle the recreational traffic.

In 1990 there were 42 locks whose traffic included 3,000 or more recreational vessels (Table 8). Thirteen locks, six of them on the Upper Mississippi River, locked through more than 10,000 recreational vessels. Seventeen locks had 5,000 to 9,000 recreational vessels and 12 had 3,000 to 5,000 pass through. Eighteen of the 42 locks with high recreational use were on the Upper Mississippi, all north of Davenport, Iowa. In addition, there were four locks on the Ohio River system on the Allegheny, Tennessee, Ohio, and Cumberland Rivers with high recreational lockages. The Okeechobee River had five locks and the Illinois Waterway had four locks with high recreational usages. Locks with heavy recreational vessel traffic tended to be near major metropolitan areas, including Minneapolis - St. Paul, Seattle, Chicago, Norfolk, Buffalo, Pittsburgh, Davenport, Chattanooga, and St. Louis. Residents near the Upper Mississippi seem to have a greater propensity to use the waterways for recreational boating.

At the 42 locks with heavy recreational traffic the percentage of total lockages that were recreational exceeded 60 percent at 37 locks. Recreational

TABLE 8: LOCKS WITH OVER 3,000 RECREATIONAL VESSELS IN 1990

LOCK (WATERWAY)	REC. VESSELS (RANK)	REC. VESSELS (000)	REC. LOCKAGES (%)	REC. TIME UTIL. (1)
CHICAGO LOCK (CHICAGO HARBOR)(2)	1	31.4	96.9	25.9
HIRAM M. CHITTENDEN (LAKE WASHINGTON)(2)	2	27.8	73.9	20.5
CANAVERAL (CANAVERAL HARBOR)(2)	3	25.7	96.1	33.5
L&D 3 (UPPER MISS)	4	17.8	91.2	55.8
T.J. O'BRIEN (ILLINOIS)	5	15.7	83.6	24.8
CALCASIEU SALT WATER (CALCASIEU R.)(2)	6	12.7	98.3	44.8
L&D 7 (UPPER MISS)	7	12.6	87.0	53.0
L&D 2 (UPPER MISS)	8	12.2	86.8	53.0
L&D 4 (UPPER MISS)	9	12.1	87.8	50.9
W.P. FRANKLIN (OKEECHOBEE)(2)	10	11.8	95.9	11.8
ALBEMARLE & CHEASPEAKE (AIWW)	11	11.2	80.7	19.6
L&D 5A (UPPER MISS)	12	10.7	85.5	47.3
L&D 6 (UPPER MISS)	13	10.2	85.1	50.9
BLACK ROCK (BLACK ROCK)(2)	14	8.8	93.1	32.3
L&D 5 (UPPER MISS)	15	8.7	83.7	47.8
L&D 2 (ALLEGHENY)	16	7.8	77.9	23.1
L&D 8 (UPPER MISS)	17	7.6	80.9	48.6
L&D 11 (UPPER MISS)	18	7.2	74.8	49.5
L&D 9 (UPPER MISS)	19	7.0	79.4	46.5
L&D 1 (UPPER MISS)	20	6.7	83.3	37.0
ST. LUCIE (OKEECHOBEE)(2)	21	6.6	91.8	14.6
MOORE HAVEN (OKEECHOBEE)(2)	22	6.6	96.4	22.4
HENRY HOLLAND BUCKMAN (CROSS FLORIDA)(2)	23	6.3	98.1	10.7
L&D 10 (UPPER MISS)	24	6.0	73.6	44.0
CHICKAMAUGA (TENNESSEE)	25	6.0	88.0	33.2
L&D 15 (UPPER MISS)	26	5.8	86.8	26.0
ORTONA (OKEECHOBEE)(2)	27	5.8	95.6	NA
L&D 14 (UPPER MISS)	28	5.6	100.0	68.0
TROY (HUDSON R.)(2)	29	5.3	92.3	58.9
PORT MAYACA (OKEECHOBEE)(2)	30	5.2	64.5	14.9
L&D 13 (UPPER MISS)	31	4.8	60.9	38.4
UPPER ST. ANTHONY (UPPER MISS)	32	4.7	68.9	28.1
LOWER ST. ANTHONY (UPPER MISS)	33	4.6	75.5	31.3
L&D 12 (UPPER MISS)	34	4.5	59.8	35.1
DRESDEN (ILLINOIS)	35	3.7	52.9	25.1
L&D 4 (ALLEGHENY)	36	3.6	67.9	11.7
L&D 3 (ALLEGHENY)	37	3.5	62.8	15.6
MARSEILLES (ILLINOIS)	38	3.4	52.0	31.1
STARVED ROCK (ILLINOIS)	39	3.4	50.3	25.5
COLORADO R. WEST (GIWW)	40	3.3	26.7	5.7
COLORADO R. EAST (GIWW)	41	3.0	24.8	5.7
BERWICK (ATCHAFALYA)	42	3.0	74.1	38.3

NOTES: (1) Utilization rate times percent of recreational lockages.
(2) Not on fuel taxed inland waterways.

time utilization, calculated by multiplying a lock's percentage of time utilization by that for recreational lockages, is a related measure, although it overstates recreational importance since recreational lockages take less time than commercial lockages. Still, the recreational time utilization was greater than 30 percent for 23 locks (Table 8).

A comparison of the locks with high utilization and average delay and those with heavy recreational traffic reveals little interrelationship. None of the six locks with the highest time utilization (80-100 percent) and the nine locks with the highest average delay (three or more hours) were among the 42 locks with recreational traffic of over 3,000 vessels. Among the 25 locks with time utilization of 60 to 79 percent only nine locks passed 3,000 or more recreational vessels in 1990; eight were on the Upper Mississippi and one was on the Illinois.

3.2.4 Waterway Operations During The 1988 Drought[1]

The 1988 drought mostly affected central and southeastern U.S. The central U.S. rivers involved were the Mississippi, the Missouri, the Illinois, the Ohio and its tributaries, the McClellan-Kerr Arkansas Navigation System (White River Entrance, the Ouachita/Black Rivers and the Red River. These rivers form the major north-south water transportation network of the U.S. The southeastern rivers were the Alabama River System, Appalachicola-Chattahoochee-Flint System, and Black Warrior-Tombigbee. Located between these systems was one that did not suffer from the drought, the Tennessee-Tombigbee Waterway, engineered to connect to the Mississippi by way of the Ohio.

Emergency dredging was employed, as required, to maintain navigation channels. To conduct these operations, nine contractor and four Corps dredges were used. Additional dredges were used for channel maintenance in snagging and clearing operations were also required to a lesser degree.

a. Mississippi River

The Mississippi River below St. Louis to the Gulf of Mexico has no lock and dam structures. Likewise, the Missouri River, the lower Ohio River where it joins the Mississippi, and the White River entrance to the Arkansas River are free-flowing. Maintenance dredging and river training-works (dike and revetment systems that promote natural dredging by physically preventing the channel from shifting) had always been sufficient and cost-effective measures for keeping channels at adequate depths and widths for commercial navigation on these stretches of river. The Drought of 1988, however, produced the lowest flows and stages on record for many parts of the rivers causing unprecedented problems for channel maintenance.

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[1]Excerpt from "Surviving the Drought - Corps of Engineers Response to Drought Conditions in 1988", prepared by Corps of Engineers, Institute for Water Resources, Ft. Belvoir, VA.

By early June, reports of shoalings and grounded tows were coming in from the mouth of Missouri, the lower Ohio, and several locations on the Mississippi. The channel was becoming narrower and shallower. The Corps responded by alerting the towing industry to navigation problems, and also by dispatching dredges utilizing emergency permitting authorities, and using expedited contracting procedures for procuring supplementary dredging services. The U.S. Coast Guard responded by increasing the number of buoys, performing additional reconnaissance and establishing advisories and safety zones as the situations merited. From early June through Mid-July, there were 26 temporary closures upstream from Baton Rouge. Some of these closures lasted up to 3 days while dredges worked to clear the channel. All of these closures occurred below St. Louis, where no locks and dams are constructed. Temporary blockages of shorter duration, due to grounded tows, were more frequent.

Traffic was delayed by the closures, blockages, and slow-going necessitated by the more confined channel. By June 27, there were 11 dredges working on the waterways and 110 tows being delayed due to closures. Between June 1 and 29, there were 72 grounding of tows. About 42% of those happened between June 24 and 29. Most of these grounding involved barges with drafts greater than 8.75 feet and tows with 18 or more barges. The Coast Guard implemented temporary size, depth, and configuration restrictions on tows within designated safety zones to prevent further grounding. These restrictions caused the barges to be light-loaded (thus drawing less draft) with fewer barges per tow. Other safety devices instituted at some areas included one-way/alternating traffic and daytime traffic only. The exact nature of the restrictions were changed as river conditions changed. The combination of these factors caused shipments of commodities to take much longer to reach their destinations. But, because of the actions of the Corps in concert with the Coast Guard and towing industry, particularly be means of the ad hoc River Industry Executive Task Force (RIETF), commerce continued.

From mid-July through the end of the drought period, there were four more blockages on the Mississippi River due to shoaling. Dredging continued at problem spots to insure that further blockages would not occur. Navigation was still difficult and slow due to low water conditions. As of August 19, the Mississippi from St. Louis to Baton Rouge was still limited to 20 barges per tow upbound and 16 barges per tow downbound with drafts of 8.5 feet. Normal tow sizes for the Mississippi are around 30-40 fully loaded barges per tow with 9-foot drafts and large horse-power tow boats, some drawing 9 feet or more.

On September 2, the U.S. Coast Guard at Memphis canceled the safety zone on the Lower Mississippi River and recommended limits of 8.5 feet drafts, 25-barge tows upbound, and 20-barge tows downbound. On September 28, the Lower Mississippi River Committee recommended that all operators limit tows to a maximum of 25 jumbo hopper barges north and south bound.

b. Missouri River

(1) The Missouri River empties into the Mississippi River just above St. Louis. It has a series of dams on the mainstem and tributaries that are operated for flood control, hydropower, navigation, municipal and industrial water supply, water quality, fish and wildlife, and recreation. Controlled releases also contribute significantly to the flow for navigation on the Mississippi River.

(2) Emergency dredging was performed on the half-mile stretch at the Missouri's confluence with the Mississippi, and later at two other locations upstream (mile 41 and 13) to improve a restricted navigation channel. This dredging was the first required on the Missouri River navigation channel since 1979. Conditions still required the towing industry to reduce barge loadings

and the number of barges per tow. By mid-July, "double tripping", where tows would have to break up and take as few as one barge at a time through problem spots, became common at the mouth.

c. Ohio River

The Ohio River and its tributaries form an extensive network of waterways that connect much of the interior eastern U.S. with the Gulf of Mexico, by way of the Mississippi River and Tennessee-Tombigbee Waterway. The Ohio River Navigation System is controlled by locks and dams, except for the 18-mile reach between the last lock and dam (number 53) and the confluence with the Mississippi at Cairo, IL. Sufficient water supply for navigation and other purposes was maintained throughout the system above L&D 53 due to the efficient operation of the 77 reservoirs in the basin. However, the uncontrolled 18-mile stretch between L&D 53 and the mouth suffered record-breaking low water and required extensive dredging by the Corps and traffic control by the U.S. Coast Guard to keep tows moving.

Falling stages and associated shoaling created major bottlenecks on this lower section of the Ohio, especially in the vicinity of Mound City, IL. On June 13, several tows ran aground. The U.S. Coast Guard declared a safety zone on June 14 that eventually included the entire reach from the lower approaches of L&D 53 to Cairo, IL, in which traffic control and tow restrictions were implemented. As river conditions changed, tow size restrictions varied from 8 to 15 barges per tow with variations depending on the direction of travel and mix of loaded and empty barges. Draft restrictions also varied. The zone was closed to traffic on several occasions to permit Corps dredging of shoals. One-way traffic and intermittent delays were required to permit passage in the vicinity of dredge operations.

From June 14 through July 4, 1988, an emergency channel was under continuous dredging within the U.S. Coast Guard safety zone. The channel had to be closed to traffic from June 14-18 to allow dredges to move in and reopen the channel. Personnel were on the scene 24 hours a day, 7 days a week during the emergency dredging operation.

Through August, continuous dredging was required for the lower Ohio. Dredging was completed by August 21, and on August 22, the U.S. Coast Guard discontinued the safety zone on the lower Ohio. No navigation problems have been reported since.

d. White River Entrance

The McClellan-Kerr Arkansas River Navigation System empties into the Mississippi River about midway between Cairo, IL and Baton Rouge, LA. The system is controlled by locks and dams, although the last 10-mile reach of the northern entrance to the system from the Mississippi is free-flowing. By late June, the overall system was suffering from low flows but remained open to navigation with restrictions. There were no blockages except on this last 10-mile reach at the White River entrance.

Shoaling on the lower White River existed at six locations by late June. Dredges were used to restore the channel. Coast Guard tow-size and draft restrictions were in effect for upstream and downstream tows. Restrictions were changed as conditions changed. On July 8, record low water was recorded in the channel. By July 12, one loaded barge at a time was allowed to pass downstream and two at a time upstream. Dredging continued around-the-clock and conditions stabilized by July 21.

By early September, only one or two dredges, still working around-the-clock, were needed and navigation restrictions were eased permitting larger

tow sizes. Dredging was essentially completed by mid-October, but navigation was still restricted to daylight operations and narrow tow widths.

e. Tennessee-Tombigbee Waterway

The Tennessee-Tombigbee (Tenn-Tom), which runs parallel to the Mississippi and connects the Tennessee River with the Tombigbee and Mobile Rivers, guaranteed movement of critical shipments needed to keep plants open that might otherwise have been forced to shut down. The more predictable and trouble-free route offered by the Tenn-Tom attracted a significant amount of commerce that would have normally used the Mississippi. Traffic through Bay Springs Lock, located on the upper Tombigbee, increased by 260% during 1988 over 1987. Prudent operation of the Tenn-Tom, TVA projects, and related systems resulted in a highly successful navigation season with no grounding or blockages reported.

There are two tributary waterways on the Mobile River, -- the Black Warrior-Tombigbee System and the Alabama River System. The Black Warrior-Tombigbee experienced no navigation problems during the drought. The Alabama, however, became virtually un-navigable for most commercial users after July 4. Constrictive controlling depths and widths were experienced from July through September. Tow-size restrictions were in effect through November 8. By mid-September dredging to restore channel depths and widths began and continued into November.

f. Apalachicola-Chattahoochee-Flint

The Apalachicola-Chattahoochee-Flint (ACF), draining area east of the Alabama River, is controlled to some extent by locks and dams. The Flint River portion of the system is uncontrolled. The ACF experienced very low flows, and upstream releases were not available to augment flow for navigation. As a result, the system was closed to commercial traffic from July 5 to September 6, 1988. In early September, though, the Corps was able to release enough water from upstream projects for a 2-week period to provide a 7.5 foot channel enabling critical farm and fertilizer products to be moved.

3.3 COMMERCIAL FLEET

This section describes the characteristics and utilization of the existing fleet of vessels serving the inland waterways. Three vessel types are considered: dry cargo barges, tank or liquid cargo barges, and towboats/tugboats.

3.3.1 Dry Cargo Barges

In 1989 there were about 27,000 dry cargo barges in the United States fleet with a total cargo capacity of over 38 million tons or 1,410 tons per barge (Table 9). Since 1950 the number of barges has grown 140 percent from just over 11,300 to its present size. The fleet's cargo capacity has increased from less than 8 million tons, an increase of 380 percent. The average capacity per barge has doubled from 700 tons over the past 38 years. The dry cargo barge fleet is predominantly open hopper, covered hopper, and deck or flat barges. They are employed on the shallow-draft waterways as well as in deep-draft areas along the coasts and on the Great Lakes.

In the Mississippi River - GIWW region in 1989 there were over 23,100 dry cargo barges with a total cargo capacity approaching 33 million tons. This region propelled the U.S. fleet's growth. Operating in the region are about 50 different types and sizes of barges. Dry cargo barges comprise 88 percent of the barges and 82 percent of cargo capacity in the region, and they average 15 years in age (Table 10). The 195 foot length predominates, comprising

TABLE 9. DRY CARGO BARGE FLEET FOR THE UNITED STATES AND THE MISSISSIPPI-GIWW REGION, 1950-1989

YEAR	TOTAL NUMBER	PERCENT CHANGE	TOTAL CAPACITY	PERCENT CHANGE	AVG. CAP./ BARGE	PERCENT CHANGE
			United States			
1950	11,339	---	7,860,688	---	693	---
1955	12,400	9.4	9,685,485	23.2	781	12.7
1960	14,025	13.1	12,188,956	25.8	869	11.3
1965	14,241	1.5	14,607,733	19.8	1,026	18.1
1970	15,890	11.6	17,695,275	21.1	1,114	8.6
1975	21,876	37.7	25,525,996	44.3	1,167	4.8
1980	27,426	25.4	34,486,851	35.1	1,257	7.7
1985	29,287	6.8	38,633,297	12.0	1,319	4.9
1989	27,073	-7.6	38,124,034	-1.3	1,408	6.7
1950-1989		138.8		385.0		103.2
			Mississippi-GIWW Region			
1950	5,563	---	4,375,975	---	787	---
1955	7,466	34.2	6,454,542	47.5	865	10.0
1960	9,672	29.5	9,117,836	41.3	942	8.9
1965	10,679	10.4	11,131,581	22.1	1,042	9.6
1970	12,550	17.5	14,284,009	28.3	1,138	9.2
1975	17,345	38.2	21,031,652	47.2	1,213	6.6
1980	22,586	30.2	29,261,091	39.1	1,296	6.8
1985	24,442	8.2	33,071,147	13.0	1,353	4.4
1989	23,124	-5.4	32,567,973	-1.5	1,408	4.1
1950-1989		315.7		644.2		78.9

Source: USACE Waterborne Commerce Statistics Center, WRSC-TL-89, Waterborne Transportation Lines of the U.S., 1989.

TABLE 10. MISSISSIPPI-GIWW REGION DRY CARGO BARGE FLEET CHARACTERISTICS BY TYPE AND SIZE CATEGORY, 1989

BARGE TYPE AND SIZE	BARGES NO.	BARGES %	CARGO CAPACITY IN TONS NO.	CARGO CAPACITY IN TONS %	CARGO CAPACITY IN TONS AVG.	AVG. AGE
OPEN HOPPER						
Less than 170'	237	3	144,292	1	611	33
170' -180'	1,169	16	1,112,064	11	951	18
190' -200'	6,029	80	9,064,967	87	1,504	14
225' -250'	65	1	133,618	1	2,056	12
250' -300'	1	0	3,200	0	3,200	33
Over 300'	1	0	3,600	0	3,600	19
	7,502	32	10,461,741	32	1,395	15
COVERED HOPPER						
Less than 170'	28	0	16,096	0	575	36
170' -180'	26	0	24,923	0	959	35
190' -200'	10,189	99	15,739,027	99	1,545	13
200' -225'	2	0	2,750	0	1,375	27
225' -250'	9	0	35,344	0	3,927	14
250' -300'	16	0	49,322	0	3,083	18
Over 300'	2	0	17,800	0	8,900	8
Unknown	2	0	3,018	0	1,509	-
	10,274	44	15,888,280	49	1,546	13
DECK/FLAT						
Less than 170'	1,496	65	779,657	34	531	23
170' -180'	113	5	166,952	7	1,477	22
180' -190'	9	0	12,104	1	1,345	24
190' -200'	557	24	815,581	36	1,480	19
200' -225'	16	1	33,442	1	2,090	35
225' -250'	80	3	263,476	12	3,293	16
250' -300'	21	1	93,564	4	4,455	19
Over 300'	5	0	110,919	5	22,184	16
Unknown	9	0	2,200	0	440	14
	2,306	10	2,277,895	7	988	22
LASH/SEABEE						
Less than 170'	670	100	295,619	100	441	16
	670	3	295,619	1	441	16
OTHER/UNKNOWN						
Less than 170'	635	27	320,931	9	526	27
170' -180'	44	2	45,788	1	1,117	26
180' -190'	2	0	1,825	0	913	10
190' -200'	1,494	63	2,296,949	64	1,549	9
200' -225'	1	0	1,904	0	1,904	23
225' -250'	27	1	72,406	2	2,682	20
250' -300'	122	5	377,118	10	3,117	7
Over 300'	26	1	479,767	13	20,859	16
Unknown	3	0	1,950	0	650	9
	2,354	10	3,598,638	11	1,529	14
TOTAL	23,106	100	32,522,173	100	1,408	15

Source: *WRSC-TL-89*

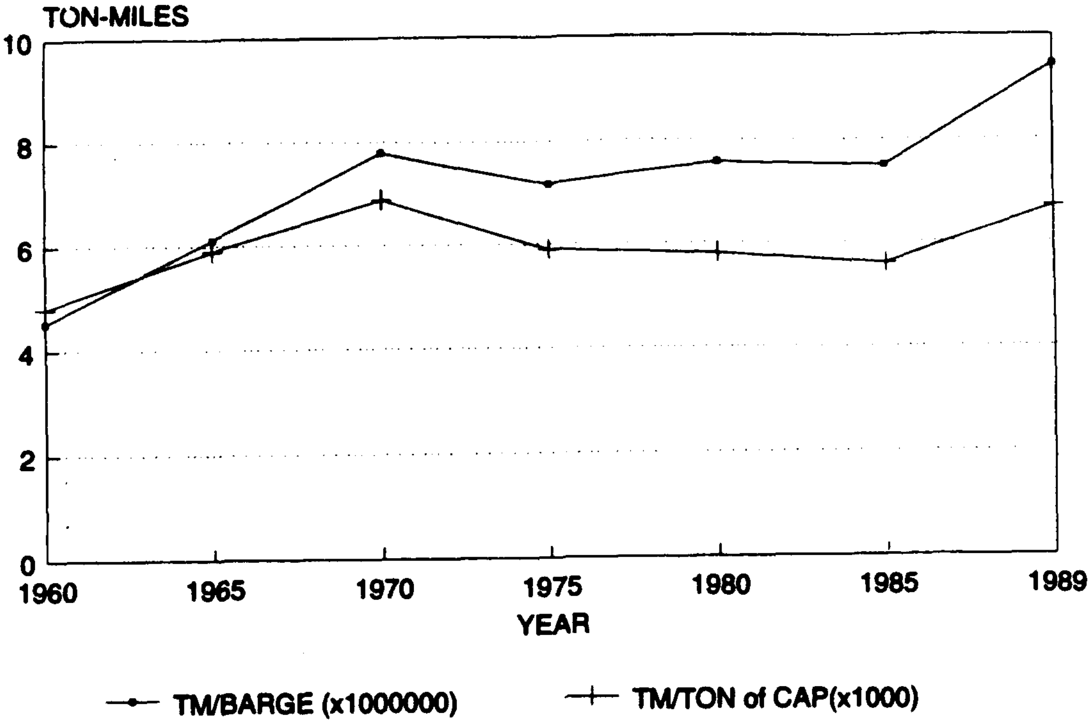


FIGURE 10: DRY CARGO UTILIZATION IN TON-MILES
FOR MISSISSIPPI-GIWW REGION

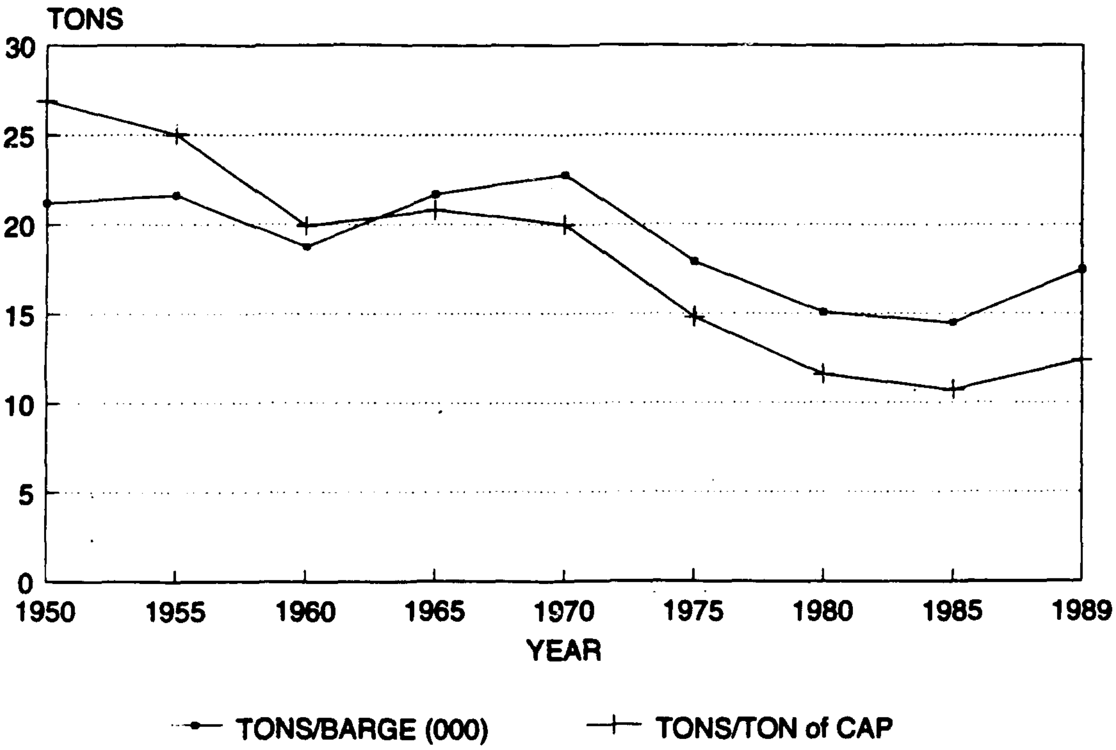


FIGURE 11: DRY CARGO BARGE FLEET UTILIZATION IN TONS
FOR MISSISSIPPI-GIWW REGION

approximately 75 percent of the region's barges and cargo capacity. Jumbo barges are 35 feet wide while standard barges are 26 feet wide and shorter. Covered hopper barges account for about half and open hopper barges for one-third of the region's dry cargo barge capacity.

Utilization levels for dry cargo barges and their cargo carrying capacity generally increased from 1950 until 1970, dropped markedly through 1985 because the fleet's growth was even greater than the growth in waterway traffic, but returned to levels of the 1970s by 1989 (Figures 10 and 11). Utilization expressed in ton-miles was more favorable before 1970 than that for tons, and the decline afterwards more moderate due to the 55 percent increase in the average length of haul. From 1960 to 1970 utilization in ton-miles per barge grew 70 percent before declining 5 percent during the next fifteen years. Utilization in ton-miles per ton of capacity grew more moderately (45 percent) between 1960 and 1970 before reversing by 20 percent in the next fifteen years. By 1989 utilization in ton-miles per barge achieved a new peak while ton-miles per ton of cargo capacity almost returned to the peak of 1970. Utilization in tons per barge rose less (10 percent) from 1950 to 1960, but then between 1970 and 1985 fell more than ton-miles (off 35 percent). Cargo capacity utilization in tons shipped per ton of capacity had been declining 25 percent between 1950 and 1970, but the rate of decline nearly doubled to 45 percent between 1970 and 1985. Utilization for 1989 in tons per barge and tons per ton of capacity nearly recovered to levels present in 1975.

3.3.2 Tank Barges

The nation's tank barge fleet in 1989 was nearly 4,000 barges with a total cargo capacity of 10.7 million tons (Table 11). Since 1950 the number of barges has almost doubled. However, the fleet's cargo capacity has increased at triple that rate (315 percent) from just over 2.6 million tons. Tank barges are employed in the same regions of the country as are dry cargo barges.

In the Mississippi River - GIWW region in 1989 there were nearly 3,250 tank barges with a total cargo capacity approaching 7 million tons (Table 12). The three most common barge lengths are, in order of importance 190 - 200, 250 - 300, and less than 170 foot lengths. There is also greater diversity in barge widths. Compartmented barges account for 60 percent of the barges (1,950) and total capacity (4.2 million tons) and average 19 years old. Non-compartmented barges account for 40 percent of the barges (1,270) and total capacity (2.7 million tons) and also average 19 years old.

Utilization of liquid cargo barges between 1950 and 1985 was generally similar to utilization of dry cargo barges, gradually reaching a peak around 1970, sharply declining through 1985, and then returning to 1980 levels in 1989 (Figure 12). Between 1960 and 1970 utilization in ton-miles per barge grew only one percent and then fell 33 percent by 1985. In terms of cargo capacity utilization in ton-miles per ton of capacity fell 15 percent between 1960 and 1970 prior to falling 45 percent in the next fifteen years. Utilization measured in tons per base (not shown) rose 33 percent during 1950 to 1970 before dropping 25 percent in the next fifteen years to less than the 1950 level. The number of tons shipped per ton of capacity declined 20 percent in the twenty years after 1950, but decreased about twice as fast (35 percent) in the next fifteen years to 1985.

3.3.3 Towboats and Tugboats

In 1989 there were approximately 5,250 towboats and tugboats in the United States fleet (Table 13). Together the fleet totaled almost 8.7 million horsepower or over 1,500 horsepower per vessel. The fleet size grew only 30

TABLE 11. TANK BARGE FLEET, FOR THE UNITED STATES AND THE MISSISSIPPI-GIWW REGION, 1950-1989

YEAR	TOTAL NUMBER	PERCENT CHANGE	TOTAL TON CAPACITY	PERCENT CHANGE	AVG. CAP. /BARGE (tons)	PERCENT CHANGE
United States						
1950	2,050	---	2,634,090	---	1,285	---
1955	2,188	6.7	3,041,565	15.5	1,390	8.2
1960	2,429	11.0	3,716,925	22.2	1,530	10.1
1965	2,548	4.9	4,946,288	33.1	1,941	26.9
1970	3,281	28.8	6,332,749	28.0	1,930	-0.6
1975	3,524	7.4	8,201,561	29.5	2,321	20.3
1980	4,166	18.2	10,388,265	26.7	2,494	7.5
1985	4,252	2.1	10,842,430	4.4	2,550	2.2
1989	3,978	-6.4	10,711,083	-1.2	2,693	5.6
1950-89		94.0		306.6		109.6
Mississippi-GIWW Region						
1950	1,383	---	1,489,502	---	1,077	---
1955	1,513	9.4	2,284,878	5.1	1,510	40.2
1960	1,812	19.8	2,852,975	24.9	1,574	4.2
1965	2,031	12.1	4,037,480	41.5	1,988	26.3
1970	2,659	30.9	4,821,062	19.4	1,813	-8.8
1975	2,903	9.2	6,117,768	26.9	2,107	16.2
1980	3,445	18.7	7,147,532	16.8	2,075	-1.5
1985	3,529	2.4	7,317,728	2.4	2,074	0.0
1989	3,239	-8.2	6,921,246	-5.4	2,137	3.0
1950-1989		134.2		364.7		9.4

Source: WRSC-TL-89

TABLE 12. MISSISSIPPI-GIWW REGION TANK BARGE FLEET CHARACTERISTICS BY TYPE AND SIZE CATEGORY, 1989

BARGE TYPE AND SIZE	BARGES NO.	BARGES Percent	CARGO CAPACITY IN TONS NO.	CARGO CAPACITY IN TONS Percent	CARGO CAPACITY IN TONS AVG.	AVG. AGE
COMPARTMENTED						
Less than 170'						
170' -180'	312	16	406,726	10	1,316	21
180' -190'	82	4	156,430	4	1,908	23
190' -200'	22	1	45,077	1	2,049	18
200' -225'	799	41	1,245,455	30	1,561	18
225' -250'	99	5	203,087	5	2,051	23
250' -300'	139	7	341,528	8	2,457	19
Over 300'	485	25	1,703,805	41	3,520	17
Unknown	15	1	92,318	2	6,155	14
	1	0	1,450	0	1,450	21
	1,954	60	4,195,876	61	2,147	19
NON-COMPARTMENTED						
Less than 170'						
170' -180'						
180' -190'	244	19	285,606	11	1,205	23
190' -200'	42	3	69,734	3	1,701	26
200' -225'	5	0	6,820	0	1,364	30
225' -250'	415	33	621,386	23	1,497	17
250' -300'	40	3	77,201	3	1,930	25
Over 300'	66	5	165,447	6	2,585	25
Unknown	440	35	1,404,927	52	3,193	17
	18	1	69,959	3	3,887	14
	1	0	3,043	0	3,043	38
	1,271	39	2,704,123	39	2,128	19
OTHER/UNKNOWN						
Less than 170'						
190' -200'						
200' -225'						
225' -250'	6	30	4,625	14	771	18
250' -300'	8	40	11,732	36	1,467	28
	2	10	3,318	10	1,659	17
	2	10	4,400	14	2,200	4
	2	10	8,100	25	4,050	22
	20	1	32,175	0	1,609	21
TOTAL	3,245	100	6,932,174	100	2,136	19

Source: WRSC-TL-89

TABLE 13. TOWBOAT - TUGBOAT FLEET, FOR THE UNITED STATES AND THE MISSISSIPPI-GIWW REGION, 1950-1989

YEAR	TOTAL NUMBER	PERCENT CHANGE	TOTAL HORSEPOWER	PERCENT CHANGE	AVG. HPR. /TOWBOAT	PERCENT CHANGE
			United States			
1950	4,051	---	1,727,840	---	428	---
1955	4,162	2.7	2,083,576	20.6	501	17.1
1960	4,203	1.0	2,621,961	25.8	624	24.6
1965	4,054	-3.5	2,980,146	13.7	735	17.8
1970	4,248	4.8	3,858,563	29.5	908	23.5
1975	4,100	-3.5	5,088,221	31.9	1,241	36.7
1980	4,693	14.5	7,146,576	40.5	1,523	22.7
1985	4,954	5.6	8,030,407	12.4	1,621	6.4
1989	5,242	5.8	8,666,890	7.9	1,653	2.0
1950-89		29.4		401.6		286.2
			Mississippi-GIWW Region			
1950	1,489	---	744,220	---	500	---
1955	1,752	17.7	1,026,318	37.9	586	17.2
1960	1,889	7.8	1,408,710	37.3	746	27.3
1965	2,023	7.1	1,698,312	20.6	840	12.6
1970	2,297	13.5	2,274,599	33.9	990	17.9
1975	2,404	4.7	3,226,545	41.9	1,342	35.6
1980	2,945	22.5	4,637,667	43.7	1,575	17.4
1985	3,220	9.3	5,153,940	11.1	1,601	1.7
1989	3,293	2.2	5,409,889	5.0	1,643	2.6
1950-89		121.2		626.9		228.6

Source: WRSC-TL-89

percent in 39 years from less than 4,100 boats. However, its total horsepower has increased 400 percent from about 1.7 million in 1950.

In the Mississippi River - GIWW region there were almost 3,300 towboats and tugboats operating in 1989. Towboats on the waterways can be divided into three categories, workboats or fleetboats and medium and high horsepower linehaul towboats. Each has unique characteristics (Table 14). About 30 percent of the fleet are linehaul towboats propelling barges between ports and terminals on the inland waterway system. Most linehaul towboats on the inland waterway are over 100 feet long and some of the most powerful are almost 200 feet long.

Workboats and fleetboats are low horsepower vessels designed to handle and sort barges alongside terminals, to transport barges to and from fleet areas, and to break off or add on barges to linehaul tows moving in midstream. Crew accommodations are minimal and power ranges up to 1,500 horsepower. They comprise 59 percent of the fleet (2,200 boats), but only 31 percent of the total horsepower.

Medium horsepower linehaul towboats of 1500-5000 horsepower with single or twin screws handle the majority of multiple barge tows on all rivers in the inland waterways system. They comprise 24 percent of the fleet (770 boats) with 42 percent of the total horsepower operating on the Mississippi River - GIWW system. Their average age in 1988 was 17-22 years. Linehaul boats frequently turn around in the Cairo, Illinois, area, and transfer barges to and from higher horsepower towboats working the Lower Mississippi.

High horsepower linehaul towboats of 5,000-10,500 horsepower, with twin or triple screws, move the largest tows in the relatively broad reaches of the inland waterway network, such as the Lower Mississippi and Ohio Rivers. Grain shipments have attracted 10,500 horsepower towboats to points as far north as Lock and Dam 21 on the Upper Mississippi River, about 140 miles above St. Louis. They comprise seven percent of the fleet (54 towboats) with 30 percent of the horsepower. In 1989 their average age was 13 years.

In the Mississippi - GIWW region there were eight barges and 12,000 tons of cargo capacity for each towboat-tugboat in operation (Table 15). There were 205 horsepower per barge and 7.3 tons of capacity per horsepower. Since 1950 the cargo capacity per boat exhibited the greatest growth, up 205 percent from only 3,939 to 12,000 tons per boat. During the same period the number of barges per boat and horsepower per barge rose between 75 and 90 percent. The tons of cargo capacity per horsepower, however, declined seven percent during the entire period, even though it had risen 13 percent between 1950 and 1965. Barge and towboat relationships for the entire United States differed somewhat from this region.

Utilization of towboats-tugboats to propel barges transporting dry and liquid cargo grew strongly until 1975 or 1980 and then declined slightly to levels above those for 1950 (tons) and 1960 (ton-miles). In slightly different fashion utilization of towboat-tugboat horsepower, which peaked in 1970, fell off more rapidly afterwards, before reviving by 1989 (Figure 13). This was due to the slower growth in the total traffic combined with the continued growth in the number of boats and the amount of horsepower after 1970. Utilization in ton-miles per boat between 1960 and 1980 grew 80 percent before receding by 5 percent in 1985. Between 1950 and 1975 utilization based on tons per boat rose less (60 percent) before declining 20 percent in the next ten years. Horsepower utilization in ton-miles per horsepower between 1950 and 1975 eased off 5 percent, but then declined 25 percent in the next ten years. Utilization based on tons per horsepower had decreased 20 percent between 1950 and 1970 before it collapsed 50 percent in the next fifteen years. By 1989 ton-miles per boat resumed its growth to a new record level while ton-miles per horsepower turned around and surpassed the 1980 level.

TABLE 14. MISSISSIPPI-GIWW REGION TOWBOAT-TUGBOAT FLEET CHARACTERISTICS BY HORSEPOWER CLASS, 1989

HORSEPOWER CLASS	BOATS NO.	BOATS Percent	HORSEPOWER No.	HORSEPOWER Percent	AVG. HPR	AVG. AGE
Under 500	658	20	217,080	4	330	25
501-1000	1,174	36	913,284	17	778	17
1001-1500	434	13	532,403	10	1,227	16
1501-2000	264	8	468,964	9	1,776	21
2001-3000	184	6	470,296	9	2,556	19
3001-4000	182	6	633,972	12	3,483	22
4001-5000	138	4	607,940	12	4,405	17
5001-7000	187	6	1,101,100	21	5,888	13
7001-9000	44	1	357,200	7	8,118	13
Over 9000	10	0	102,400	2	10,240	13
Unknown	15	0	-	0	-	21
Total	3,290	100	5,404,639	100	1,650	19

Source: WRSC-TL-89

3.4 DOCKS AND PORTS

3.4.1 Docks

There are about 2,100 bulk cargo docks or terminals along the fuel taxed waterways, according to a 1988 summary of Corps of Engineers Port Series reports for 1982-87. The total consists of about 1350 dry bulk docks (65 percent) and 780 liquid bulk docks (35 percent). No summary data were prepared on docks not handling bulk cargo, such as general cargo, forest products, building materials, and unitized cargo. However, non bulk docks might be estimated at about 500 based on a comparison with the Maritime Administration's 1979 Mid America Ports Study. Dry bulk storage totals over 421 million bushels for grain and almost 239 million tons for all others. Liquid bulk storage totals over 134 million barrels for petroleum products, crude oil, and asphalt, 1.1 billion gallons for chemicals, miscellaneous, and molasses, and 3.4 million tons for fertilizer, ammonia, and vegetable and animal oils.

In terms of storage these facilities provide 21 million square feet of covered storage for general cargo, over 147 million tons of covered and open storage for dry bulk cargoes, 340 million barrels of tank storage for liquid bulk cargoes, and more than 355 million bushels of elevator storage for grain.

Coal, grain, sand, gravel, and stone, and miscellaneous have the largest number of dry bulk docks on the fuel taxed waterways with about 410, 310, 230, and 210 apiece. Other dry bulks have 20-70 docks each (Table 16). Average dock length is 500 to 700 feet or 2.5 to 3.5 barge lengths, except for major coal terminals which average nearly 1900 feet. Storage is present at about 70 percent of the docks. Partially offsetting the lack or shortage of storage space is the ability to load or unload directly with rail or truck, but this is important only at some coal, sand, gravel, and stone, and miscellaneous facilities. Commodity handling rates from storage to barge generally range from about 500 to 900 tons per hour, except about twice that for major coal docks and about 20,000 bushels per hour for grain (Table 17). Handling rates to storage from barge are only about 100 to 300 tons per hour, except for grain and 2,100 tons per hour at major coal terminals. The rates for grain average about 25,000 bushels per hour at major docks, but only 5,000 bushels per hour at minor docks. Coal loading rates from rail are about double those from storage while loading rates from truck are substantially less than from storage.

TABLE 15. BARGE AND TOWBOAT-TUGBOAT RELATIONSHIPS FOR THE UNITED STATES AND THE MISSISSIPPI-GIWW REGION, 1950-1989

	UNITED STATES				MISSISSIPPI - GIWW			
YEAR	BARGES /BOAT	CARGO CAP./ BOAT	HPWR/ BARGE	CARGO CAP./ HPWR	BARGES /BOAT	CARGO CAP./ BOAT	HPWR/ BARGE	CARGO CAP./ HPWR
1950	3.31	2,591	129	6.07	4.66	3,939	107	7.88
1955	3.51	3,058	143	6.11	5.93	4,988	114	8.52
1960	3.91	3,784	159	6.07	6.08	6,337	123	8.50
1965	4.14	4,823	178	6.56	6.28	7,498	134	8.93
1970	7.21	5,656	201	6.23	6.62	8,317	150	8.38
1975	8.75	8,226	200	6.63	8.42	9,219	159	8.41
1980	6.73	9,562	226	6.28	8.84	12,363	178	7.85
1985	6.77	9,987	239	6.16	8.69	12,543	184	7.84
1989	5.92	9,316	279	5.63	8.01	11,992	205	7.30
% Change	79	260	116	-7.2	72	204	92	-7.4

SOURCE: WRSC-TL-89

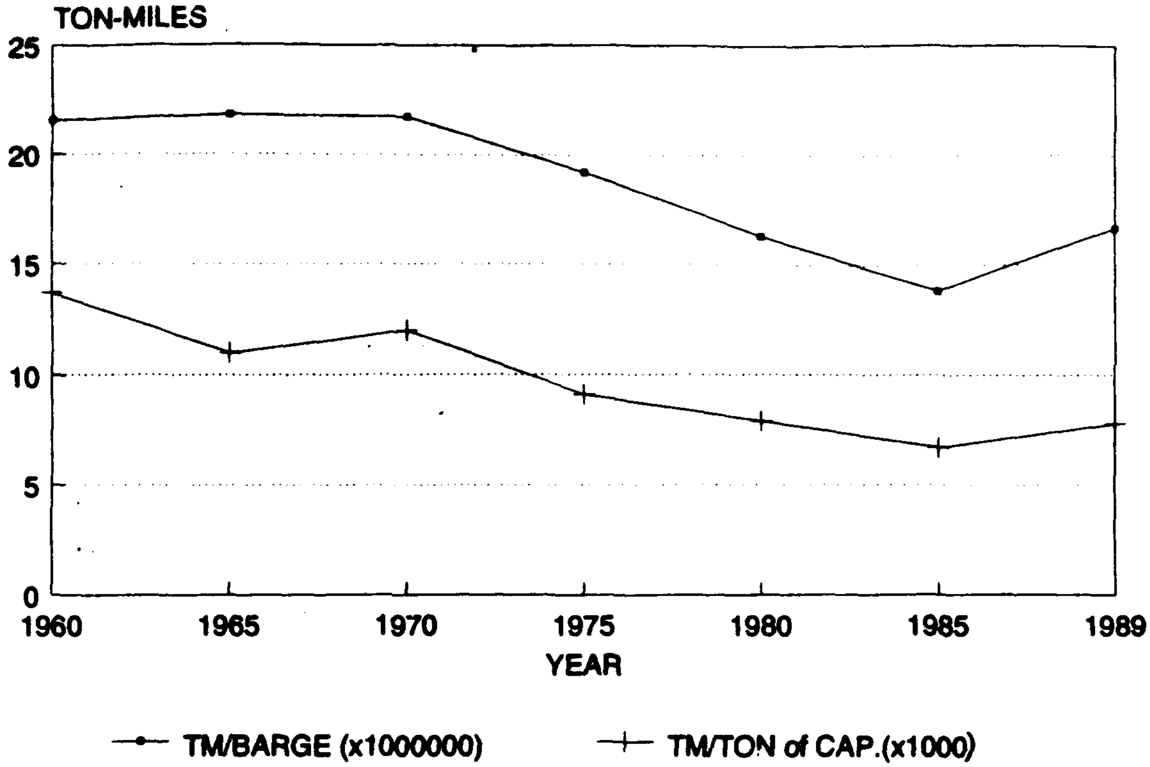


FIGURE 12: LIQUID CARGO BARGE FLEET UTILIZATION IN TON MILES FOR MISSISSIPPI-GIWW REGION

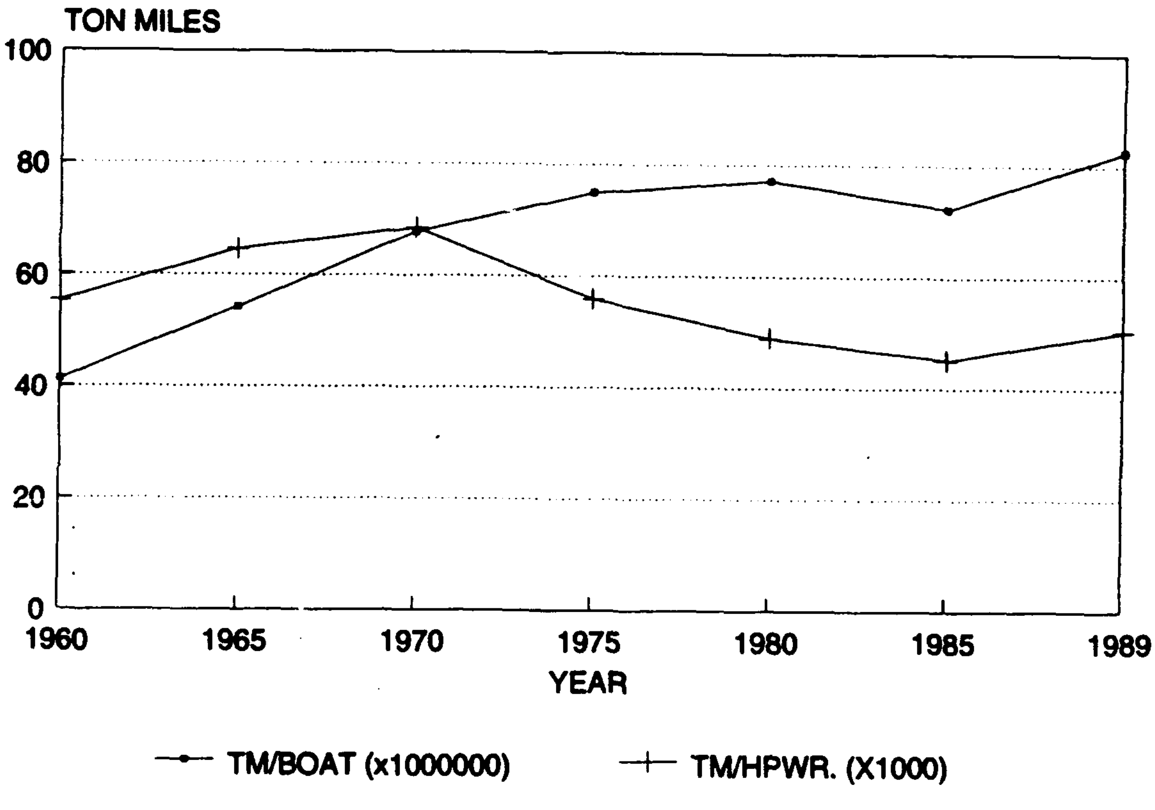


FIGURE 13: TUGBOAT-TOWBOAT FLEET UTILIZATION IN TON-MILES FOR MISSISSIPPI-GIWW REGION

TABLE 16. DRY BULK DOCK CHARACTERISTICS ON FUEL TAXED WATERWAYS, 1988

COMMODITY	TOTAL NO.	NO. W/ STORAGE	STORAGE CAPACITY (000) a/ TOTAL	STORAGE CAPACITY (000) a/ AVG.	AVG. LENGTH (FT.)	BARGE LOADING: NO. FROM RAIL	BARGE LOADING: NO. FROM TRUCK	BARGE LOADING: NO. FROM STORAGE	UNLOAD: NO. TO STORAGE
Coal - Major	101	64	70,586	1,103	1,866	16	10	30	48
Coal - Minor	307	200	23,382	117	795	16	31	118	53
Grain - Major	163	158	358,032	2,266	494	6	7	151	[illegible]
Grain - Minor	144	131	63,304	483	433	10	17	106	13
Cement	46	43	1,078	25	399	0	0	6	29
Fertilizer	71	55	2,287	42	679	1	2	7	35
Sand, Gravel, Stone	231	178	129,709	729	576	4	10	37	112
Scrap metal	31	10	1,910	191	570	0	0	3	[illegible]
Miscellaneous Ores	29	14	786	56	675	2	2	1	12
Salt	19	16	1,695	106	835	0	0	2	8
Miscellaneous	212	104	7,404	71	612	6	12	32	46
TOTAL	1,354	973	238,841			61	91	493	395

SOURCE: USACE Report NDC 88-P-1, Summary of Commodity Handling Terminals on United States Inland Waterways, October 1988.

a/ Storage units are in tons except bushels for grain. Total storage excludes grain, which is 421,336,[illegible] bushels.

TABLE 17. DRY BULK DOCK HANDLING RATES (000)[a] ON FUEL TAXED WATERWAYS, 1988

COMMODITY	RAIL TO BARGE TOTAL	RAIL TO BARGE AVG.	RAIL TO BARGE MAX.	TRUCK TO BARGE TOTAL	TRUCK TO BARGE AVG.	TRUCK TO BARGE MAX.	STORAGE TO BARGE TOTAL	STORAGE TO BARGE AVG.	STORAGE TO BARGE MAX.	BARGE TO STORAGE TOTAL	BARGE TO STORAGE AVG.	BARGE TO STORAGE MAX.
Coal - Major	44.3	2.8	5.7	6.8	0.7	1.5	45.2	1.5	5.7	100.9	2.1	8.0
Coal - Minor	24.6	1.5	6.0	13.4	0.4	0.7	87.7	0.7	3.5	46.9	0.6	5.0
Grain - Major	114.0	19.0	33.0	120.0	17.0	40.0	3281.0	22.0	80.0	214.0	24.0	30.0
Grain - Minor	170.5	17.1	50.0	275.[illegible]	16.2	60.0	1839.8	17.4	60.0	69.7	5.4	10.0
Cement	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.9	1.5	4.5	0.2	0.4
Fertilizer	1.0	1.0	1.0	1.2	0.6	1.0	4.9	0.7	1.8	9.5	0.3	0.9
Sand, Gravel, Stone	1.8	0.5	1.1	5.3	0.5	1.3	23.8	0.6	3.0	34.2	0.3	1.5
Scrap metal	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.2	0.4	0.0	0.0	[illegible]
Miscellaneous Ores	0.9	0.4	0.6	0.6	0.3	0.5	0.5	0.5	0.5	2.9	0.2	0.4
Salt	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.7	1.2	2.1	0.3	0.6
Miscellaneous	4.6	0.8	1.5	8.4	0.7	1.5	13.8	0.4	3.0	13.9	0.3	1.5

SOURCE: USACE Report NDC 88-P-1, Summary of Commodity Handling Terminals on United States Inland Waterways, October 1988.

[a] Handling rate units are in tons per hour except bushels per hour for grain.

Conveyor belt systems and crane clamshell buckets each account for about 20 percent of the total non agricultural dry bulk loading, with the front-end loader accounting for an additional 20 percent of handling equipment. The handling capacity of conveyor belt systems is variable, with a range from 400 tons per hour to 2,000 to 3,000 tons per hour. The crane clamshell handling capacity averages about 200 tons per hour. The front-end loader, while highly mobile, has an even lower handling rate. The highest rated bulk transfer systems are continuous buckets with handling capacities up to 5,000 tons per hour.

Petroleum products and chemicals have the largest number of liquid bulk docks with about 350 and 125 respectively. Seven other liquid bulk commodities have about 20-90 docks apiece (Table 18). The average length of liquid bulk docks is somewhat less than for dry bulk, about 300 to 500 feet except about 600 feet for major petroleum product terminals. About 55 percent of the facilities only receive commodities by barge while 15 percent only ship cargo. About 30 percent are capable of both receipt and shipment.

The predominant liquid bulk handling equipment is the barge pump and conventional cargo hose connected to the onshore transfer systems with load/unload capability. More than 200 pieces of loading equipment and nearly 30 pieces of unloading equipment were inventoried in the Maritime Administration study.

TABLE 18. LIQUID BULK DOCK CHARACTERISTICS ON FUEL TAXED WATERWAYS, 1988

COMMODITY (UNITS)	TOTAL NO.	NO. W/ STORAGE	AVG. LENGTH (FT.)	STORAGE CAP. (000) (BARGE CONNECTED) TOTAL	AVG.	RECEIPT &/OR SHIPMENT RCPT. ONLY	SHIP ONLY	BOTH
Pet. Prods. - Major (Brls)	70	70	608	70,505	1,008	23	7	37
Pet. Prods. - Minor (Brls)	283	277	345	36,263	131	141	4	101
Crude Oil (Barrels)	32	32	370	12,403	388	8	4	11
Asphalt (Barrels)	60	60	322	15,303	255	40	2	16
Ammonia (Tons)	36	36	502	1,155	32	21	7	8
Chemicals (Gal)	126	124	374	876,359	7,067	65	36	23
Fertilizer (Tons)	88	88	359	1,926	22	61	12	10
Molasses (Gal)	21	21	399	9,303	2,326	16	0	3
Molasses (Tons)	-	-	-	328	19	-	-	-
Veg./Animal Oils (Tons)	27	27	423	304	11	8	16	2
Miscellaneous (Gal)	33	33	488	223,144	7,695	18	3	8
Miscellaneous (Tons)	-	-	-	66	16	-	-	-
TOTAL	776	768	-	-	-	401	91	219

SOURCE: USACE Report NDC 88-P-1, Summary of Commodity Handling Terminals on United States Inland Waterwa

3.4.2 PORTS

There are 17 major shallow draft inland waterway ports recognized by the Army Corps of Engineers, with each having over a million tons of commerce (Table 19). Five of these ports (Pittsburgh, St. Louis, Huntington, Cincinnati, and Memphis) handled more than 10 million tons in 1988. Seven of the 17 ports are located along the Mississippi River, five are on the Ohio River, and the remaining five are on the Missouri, Cumberland, and Tennessee Rivers and the GIWW. In addition there are numerous deep draft ports along the coasts and Chicago on the Great Lakes where internal traffic exceeds one million tons.

Between 1973 and 1988 total commerce at the 17 major inland ports rose 25 percent from 114 to 143 million tons (Table 19). During the 15 year period the major ports' commerce as a percentage of total internal traffic grew slightly from 22 to 25 percent. Thus, three-fourths of the tonnage handled occurs outside of these major ports at docks scattered along the waterways and at cities and towns with ports not officially recognized by the Corps. Traffic at most of the ports has fluctuated, but St. Louis, Mount Vernon, and Biloxi, have experienced steady increases. The largest inland port in the nation, Pittsburgh, seems to have recovered from the recession since its traffic increased almost one-third or 8.1 million tons between 1983 and 1988. Biloxi showed the largest percent improvement over the same period, up nearly 50 percent. Meanwhile, traffic at Helena, and St. Paul dropped by over 40 percent.

Coal is the leading commodity at the major inland ports with 53 million total tons, but the ports on the Ohio River plus St. Louis and Biloxi are the only ports at which it accounts for a major portion of traffic. Over two million tons of farm products were traded at St. Louis, St. Paul, and Memphis. Traffic in petroleum and its products exceeded two million tons at four Ohio River ports and St. Louis and Memphis. Pittsburgh, St. Louis, and Nashville moved more than two million tons of non-metallic minerals, and the commodity comprised two-thirds of Nashville's commerce. St. Louis is the major port for chemicals and is second only to Pittsburgh in other commodities. Thus, St. Louis is a rapidly growing port with significant traffic over a diverse cargo base.

TABLE 19. TRAFFIC AT MAJOR SHALLOW DRAFT WATERWAY PORTS IN MILLIONS OF TONS, 1973, 1978, 1983, AND 1988

SEGMENT, WATERWAY, AND PORT	1973	1978	1983	1988	1988 COAL	1988 FARM PRODUCTS	1988 CRUDE AND PETROLEUM PRODUCTS	1988 NON METALLIC MINERALS AND PRODUCTS	1988 CHEMICALS	1988 OTHER
1 UPPER MISSISSIPPI										
Minneapolis, MN	1.8	2.2	1.5	1.6	0.5	0.3	0.0	0.7	0.1	0.1
St Paul, MN	5.1	9.7	12.1	7.0	0.4	3.1	1.1	1.7	0.4	0.2
2 MIDDLE MISSISSIPPI										
St. Louis, MO & IL	18.3	22.4	22.7	29.0	6.5	9.2	7.0	3.5	1.7	1.2
2 MISSOURI										
Kansas City, MO	1.4	2.3	1.5	2.1	0.0	0.1	0.3	1.6	0.1	0.0
3 LOWER MISSISSIPPI										
Memphis, TN	10.4	13.2	12.1	10.2	1.6	2.4	3.7	1.8	0.3	0.3
Helena, AR	3.2	3.2	2.3	1.3	0.0	0.6	0.4	0.1	0.1	0.0
Greenville,MS	2.4	3.3	2.1	2.3	0.0	0.8	0.9	0.5	0.1	0.1
Vicksburg,MS	2.8	3.4	3.0	3.2	0.0	0.7	1.7	0.3	0.2	0.5
5 OHIO										
Mount Vernon, IN	3.2	3.5	3.8	4.9	2.7	1.2	0.4	0.0	0.7	0.0
Louisville, KY	9.1	8.8	7.0	7.8	1.6	0.2	3.0	0.9	1.7	0.3
Cincinnati, OH	8.2	11.9	16.0	11.2	3.8	1.2	2.3	1.6	1.6	0.8
Huntington, WV	16.7	16.7	14.8	17.7	11.4	0.0	5.9	0.3	0.0	0.1
Pittsburgh, PA a/	23.4	20.6	26.3	34.4	22.9	0.2	3.1	5.1	1.0	2.0
5 CUMBERLAND										
Nashville, TN	3.3	2.9	2.5	3.3	0.0	0.1	0.6	2.2	0.0	0.5
5 TENNESSEE										
Guntersville, AL	1.4	1.3	2.1	1.8	0.0	1.1	0.1	0.1	0.0	0.5
Chattanooga, TN	1.7	1.6	2.6	2.5	0.0	0.6	0.5	1.3	0.0	0.1
6 GIWW										
Biloxi, MS	1.2	1.3	1.5	2.2	1.9	0.0	0.2	0.1	[illegible]	0.1
TOTAL	113.6	128.3	133.9	142.5	53.3	21.7	31.2	21.8	8.1	[illegible]
SHARE(%)					37.4	15.2	21.9	15.3	[illegible]	[illegible]

SOURCE: USACE Waterborne Commerce Statistics Center, Waterborne Commerce of the United States, Part [illegible].

a/ Also on Allegheny and Monongahela Rivers. Data for 1973 and 1978 are for old ports of Pittsburgh, Alliquipa - Rochester, and Clairton - Elizabeth.

CHAPTER 4
INLAND WATERWAY TRAFFIC: HISTORIC TRENDS AND PROJECTIONS

4.1 INTRODUCTION

A record 606 million tons of commerce were moved on the inland and intracoastal waterway system in 1990. This tonnage was more than triple the level of traffic in the years immediately following World War II and 21 million tons more than in 1989. Most of the traffic is composed of liquid and dry bulk commodities, such as petroleum and its products, coal, grain and other farm products, sand, gravel and other nonmetallic minerals, and industrial and agricultural chemicals, forest products, metal products (Figure 14).

The inland waterways carry about half of the U.S. grain exports and one-fifth of the U.S. coal exports. By moving large volumes of these commodities at a low unit cost per ton, the waterway system helps to make our exports more price competitive. It also contributes to the economies of many individual states and to the nation as a whole through providing jobs, income and production.

In addition, the system would have vital importance during a military mobilization because of its ability to move huge quantities of fuel, strategic materials, and military equipment.

The following sections present a discussion of historic inland waterway traffic through 1989 and projected tonnage through the year 2000. Significant developments by commodity and waterway are highlighted. Historic traffic data are from the U.S. Army Corps of Engineers' Waterborne Commerce Statistics Center (WCSC) in New Orleans. Projected traffic at the national level was developed by IWR using trend analysis and economic sector growth indices from various sources, including Data Resources (DRI), WEFA Group (formerly Wharton and Chase Econometrics), Sparks Companies, Inc. (SCI), U.S. Department of Agriculture (USDA), U.S. Department of Energy (DOE), and trade associations. National level forecasts were disaggregated to the waterway segment level with assistance from Corps division offices. Linear trend analysis and confidence intervals were developed for waterways exhibiting significant historic linear trend (Figures 15 through 30). For waterways with significant historical variations and no linear trend, the mean of the historic data was calculated and the projections envelope was defined using two standard deviations about the mean. The ten major commodity groups analyzed are:

1. Farm Products
2. Metallic Ores, Products and Scrap
3. Coal
4. Crude Petroleum
5. Nonmetallic Minerals/Products
6. Forest Products
7. Industrial Chemicals
8. Agricultural Chemicals
9. Petroleum Products
10. All Other Commodities

4.2 TOTAL TRAFFIC

4.2.1 Historic

Total traffic on U.S. shallow draft inland and intracoastal waterways (defined here as "internal" traffic) increased steadily after the end of World War II, at a robust average annual growth rate of 4.2 percent, until the 1978-80 period. Total U.S. internal traffic, historic and projected is shown in Table 20 and Figure 14. A drop in waterway traffic occurred in 1980-1983, due to a combination of factors, including an overall economic downturn in the United States and many other countries, a substantial restructuring in basic

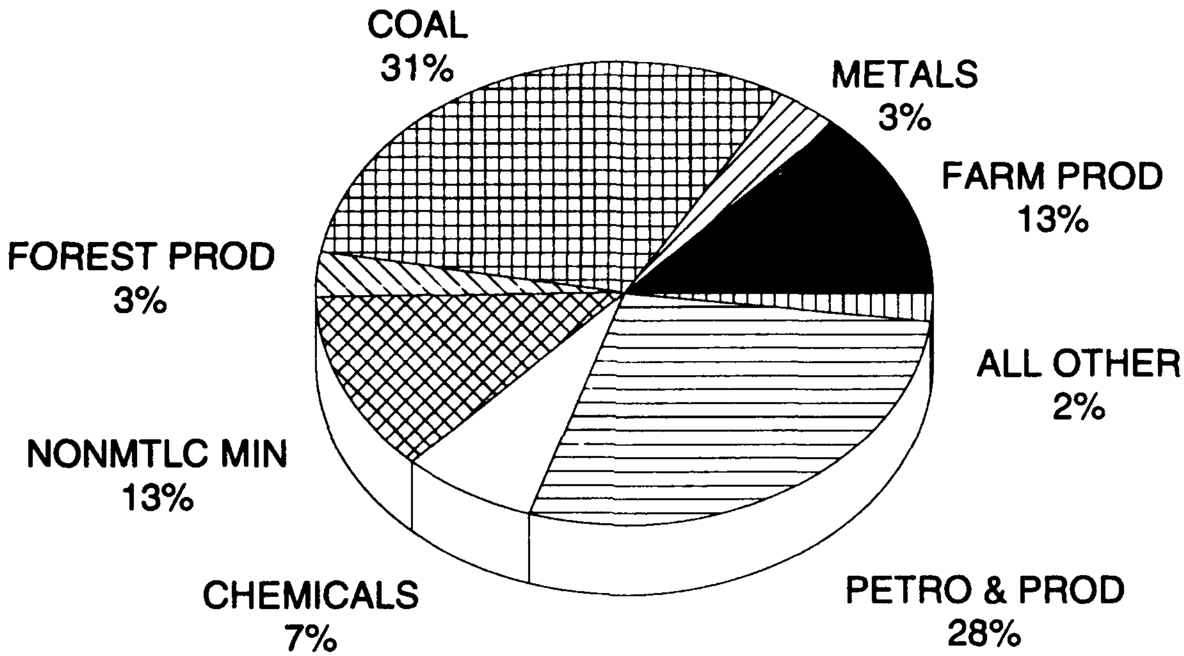


FIGURE 14: U.S. INLAND WATERWAY TRAFFIC
PERCENT BY COMMODITY GROUP, 1990

TOTAL: 618 MILLION TONS

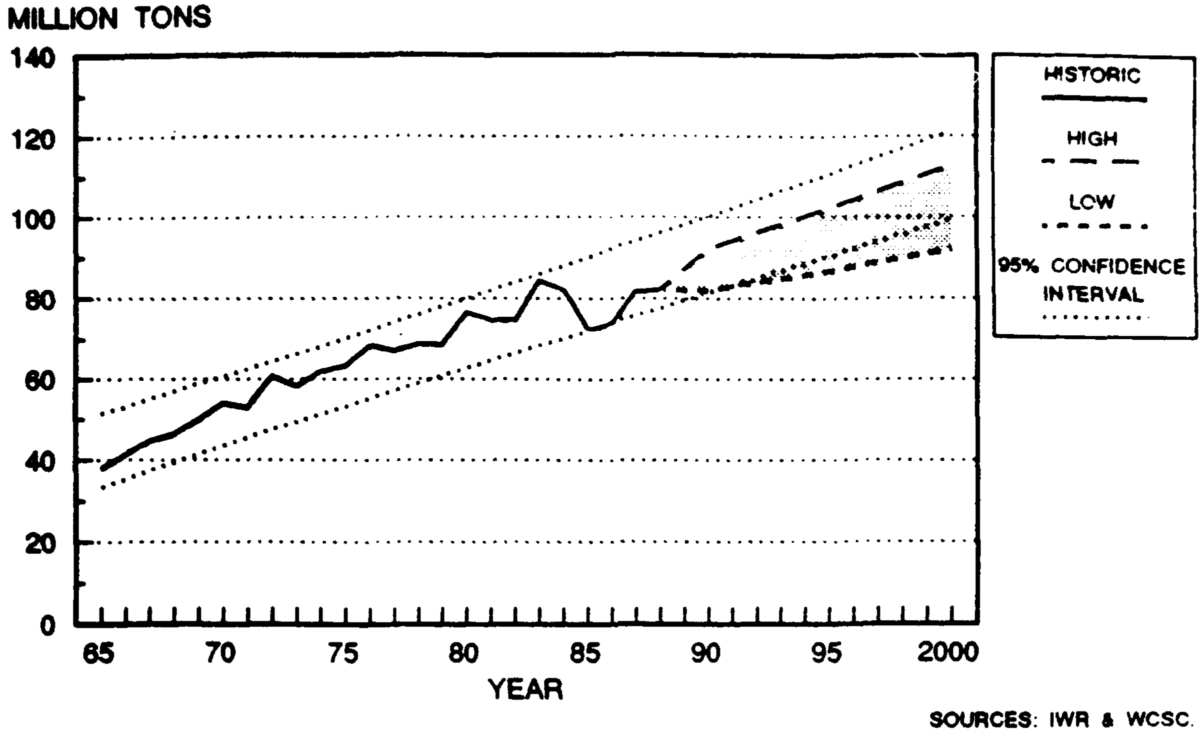


FIGURE 15: SEGMENT 1 - UPPER MISSISSIPPI RIVER TRAFFIC HISTORIC AND PROJECTED: 1965-2000

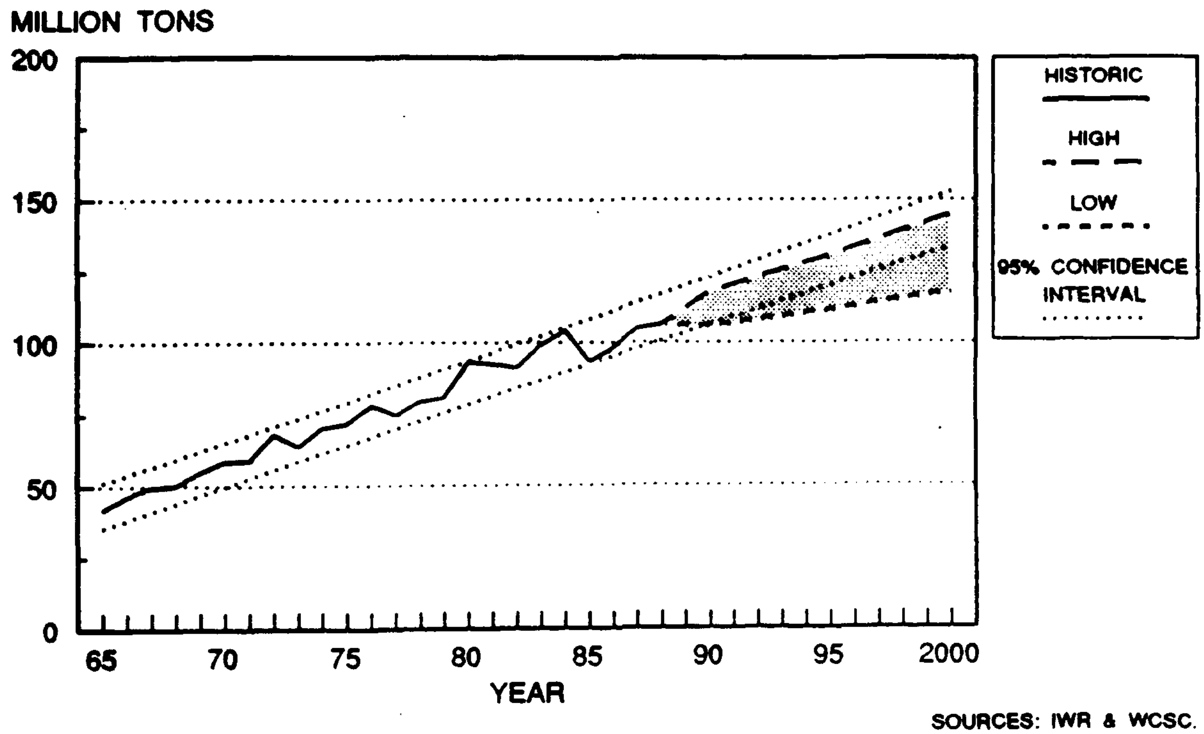


FIGURE 16: SEGMENT 2 - MIDDLE MISSISSIPPI RIVER TRAFFIC HISTORIC AND PROJECTED: 1965-2000

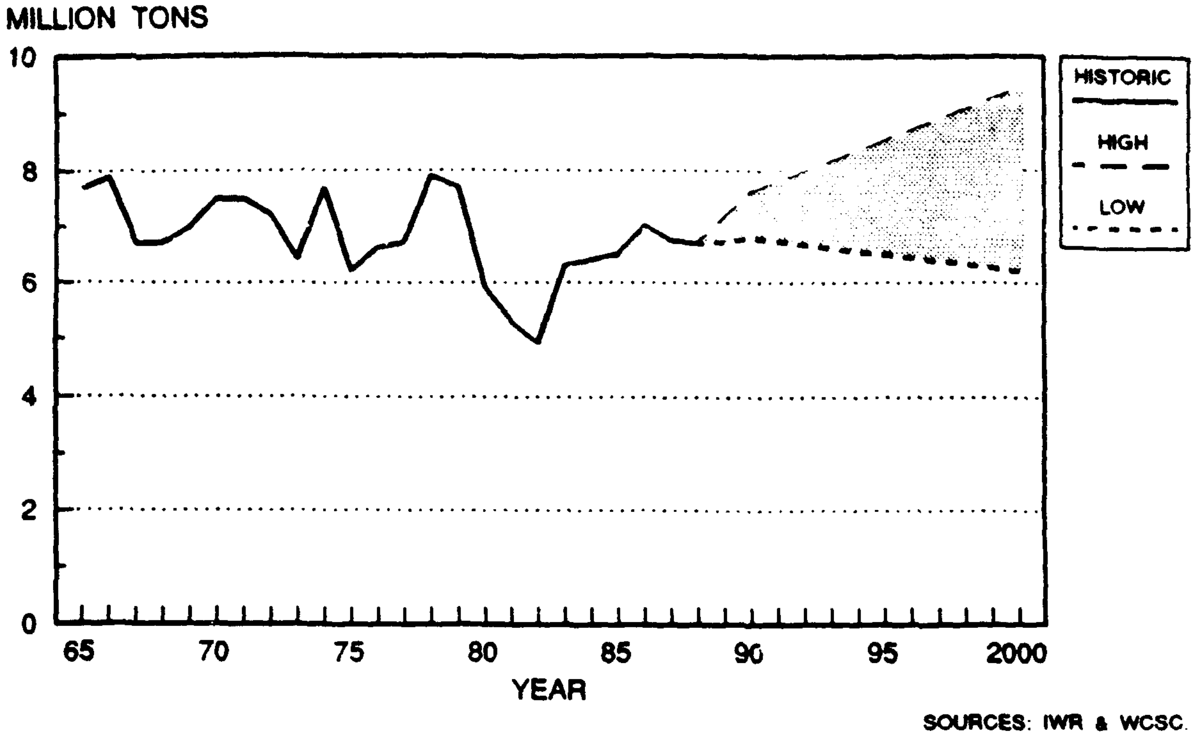


FIGURE 17: SEGMENT 2 - MISSOURI RIVER TRAFFIC
HISTORIC AND PROJECTED: 1965-2000

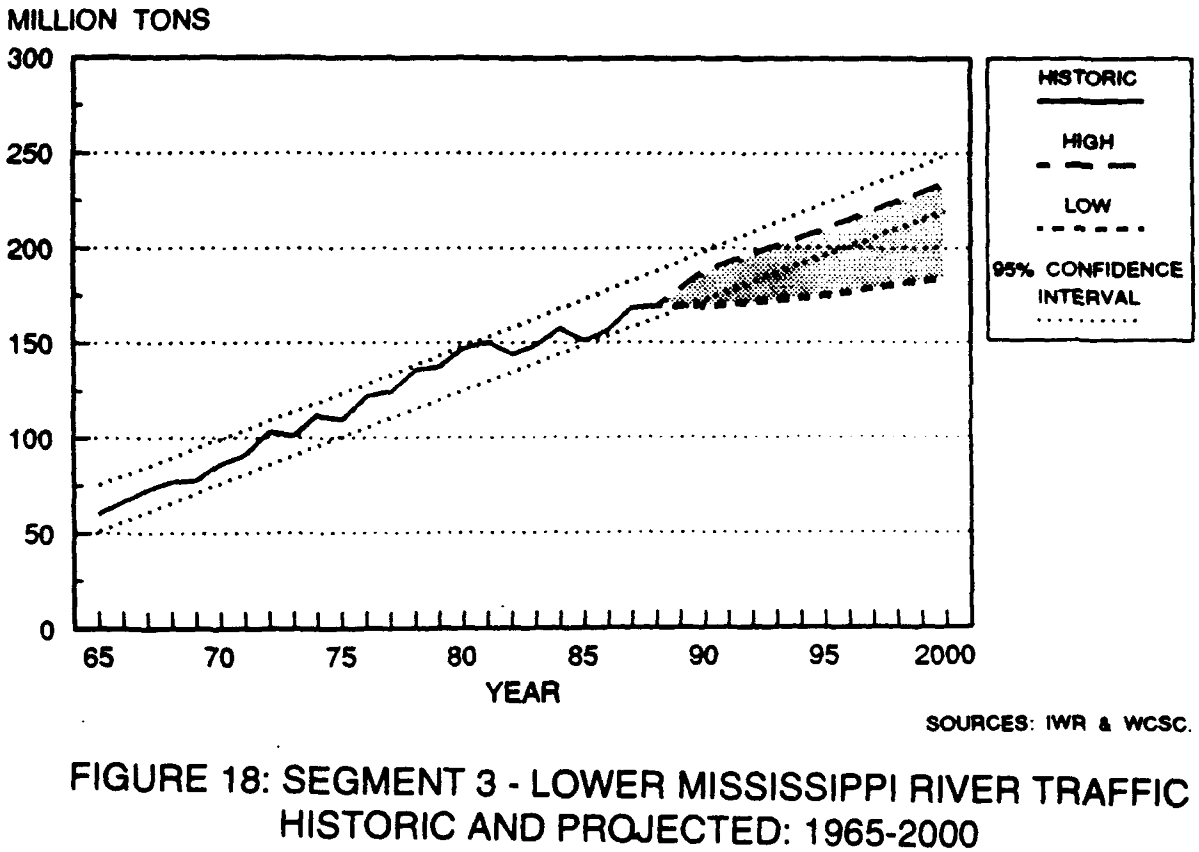


FIGURE 18: SEGMENT 3 - LOWER MISSISSIPPI RIVER TRAFFIC
HISTORIC AND PROJECTED: 1965-2000

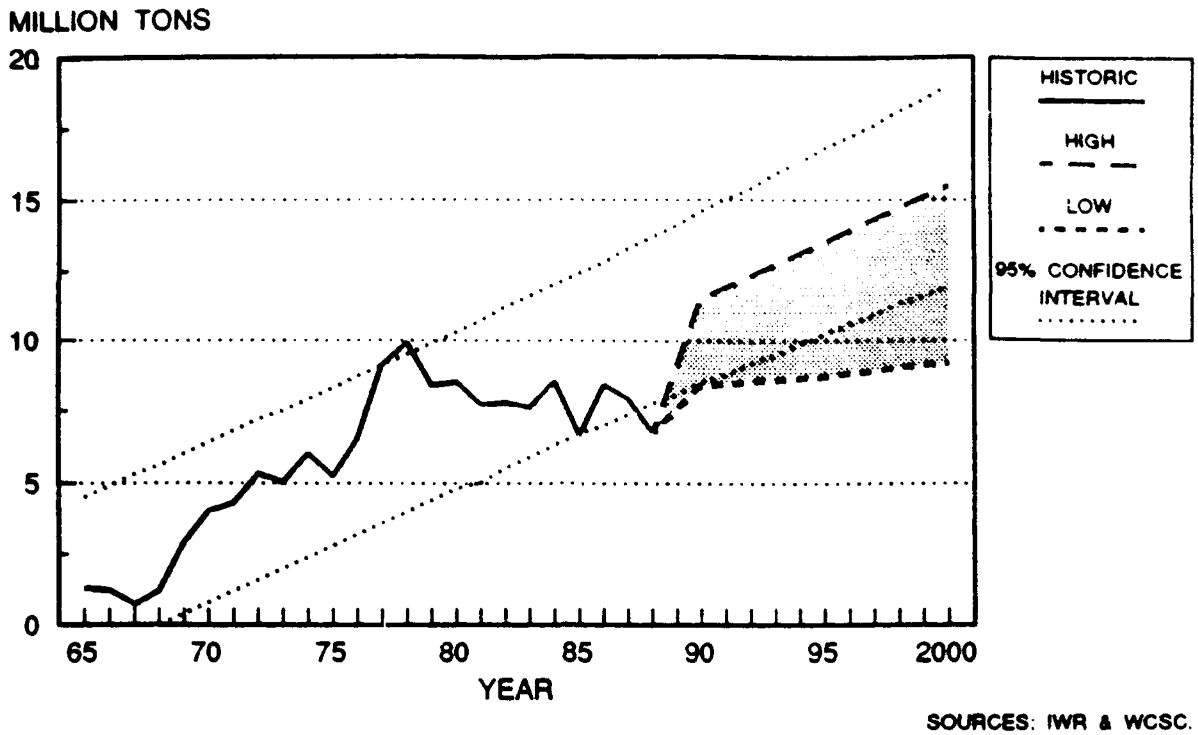


FIGURE 19: SEGMENT 3 - ARKANSAS RIVER TRAFFIC
HISTORIC AND PROJECTED: 1965-2000

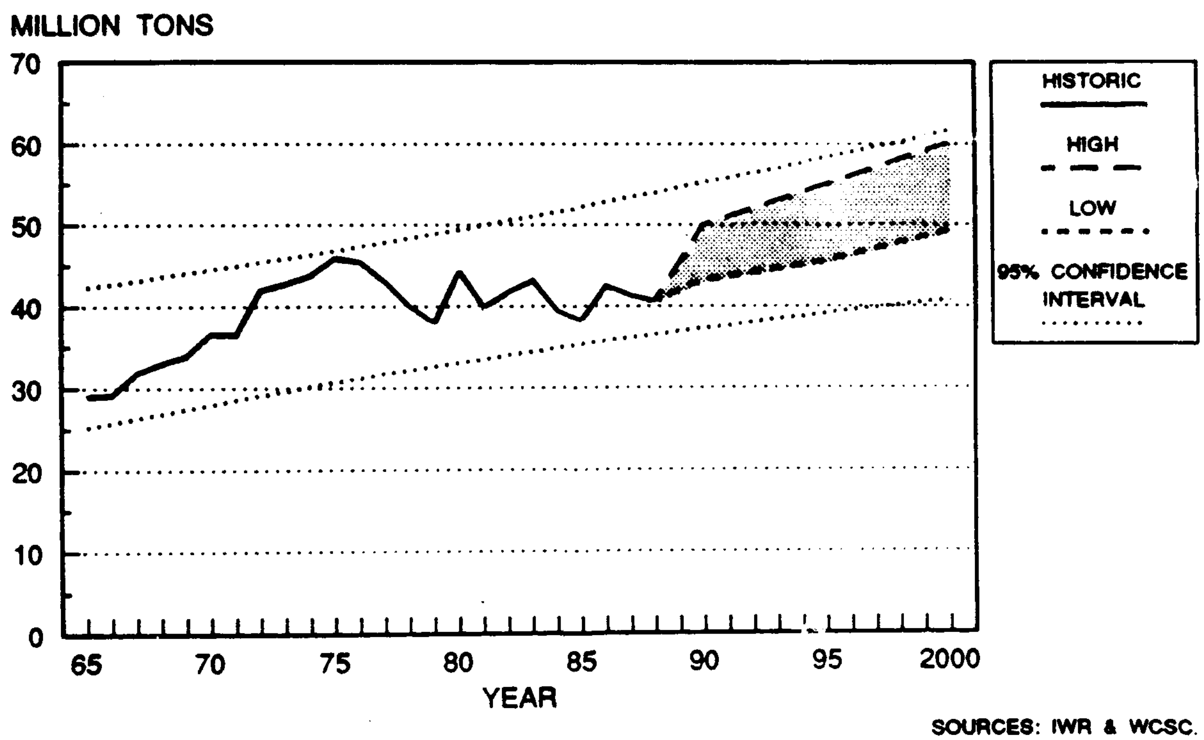


FIGURE 20: SEGMENT 4 - ILLINOIS WATERWAY TRAFFIC
HISTORIC AND PROJECTED: 1965-2000

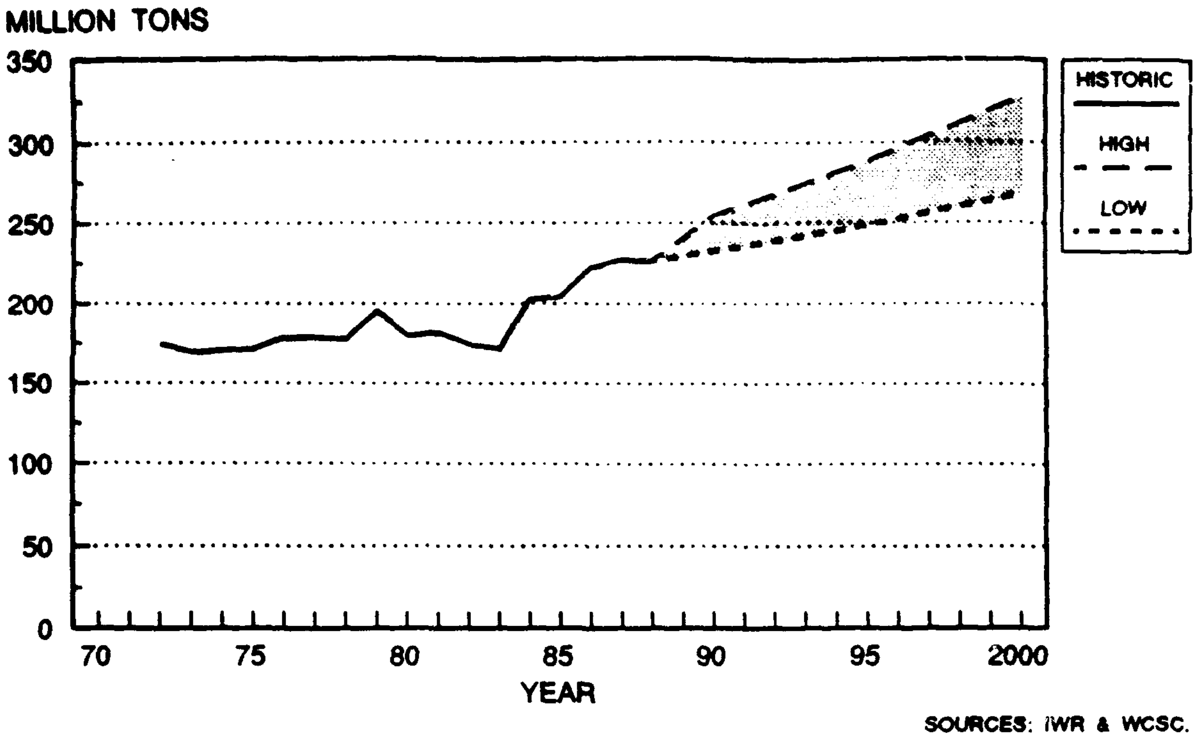


FIGURE 21: SEGMENT 5 - OHIO RIVER SYSTEM
HISTORIC AND PROJECTED: 1972-2000

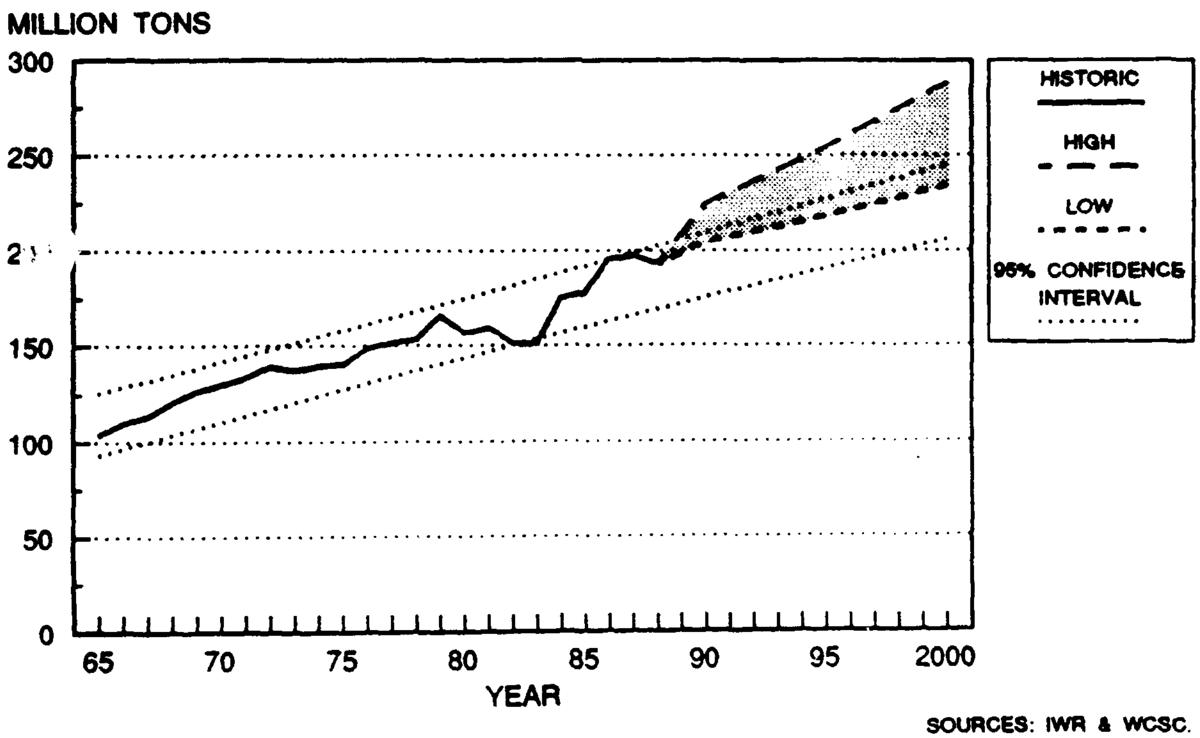
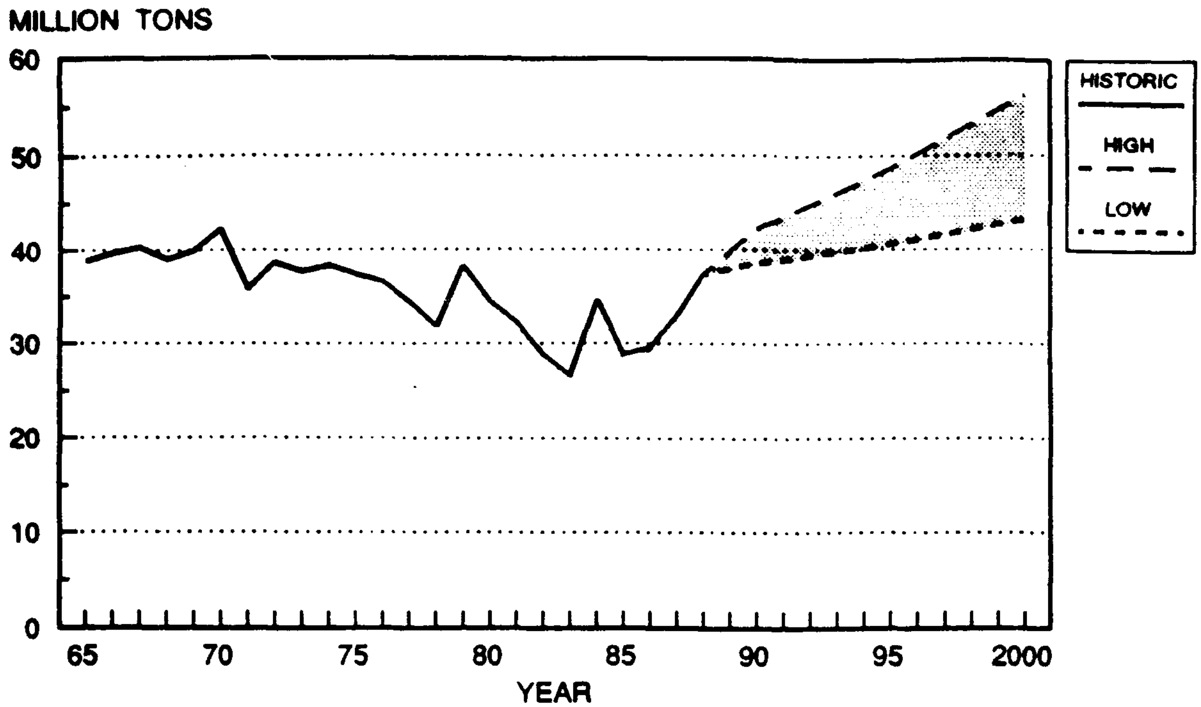
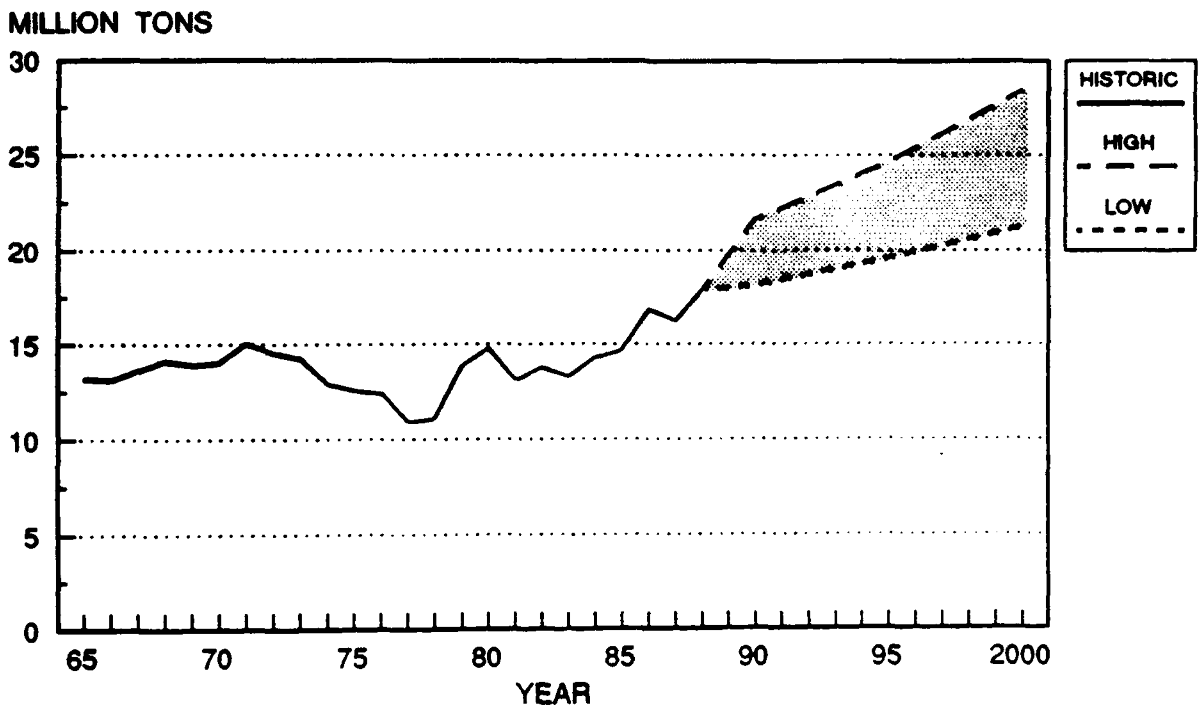


FIGURE 22: SEGMENT 5 - OHIO RIVER-MAINSTEM TRAFFIC
HISTORIC AND PROJECTED: 1965-2000



SOURCES: IWR & WCSC.

FIGURE 23: SEGMENT 5 - MONONGAHELA RIVER TRAFFIC
HISTORIC AND PROJECTED: 1965-2000



SOURCES: IWR & WCSC.

FIGURE 24: SEGMENT 5 - KANAWHA RIVER TRAFFIC
HISTORIC AND PROJECTED: 1965-2000

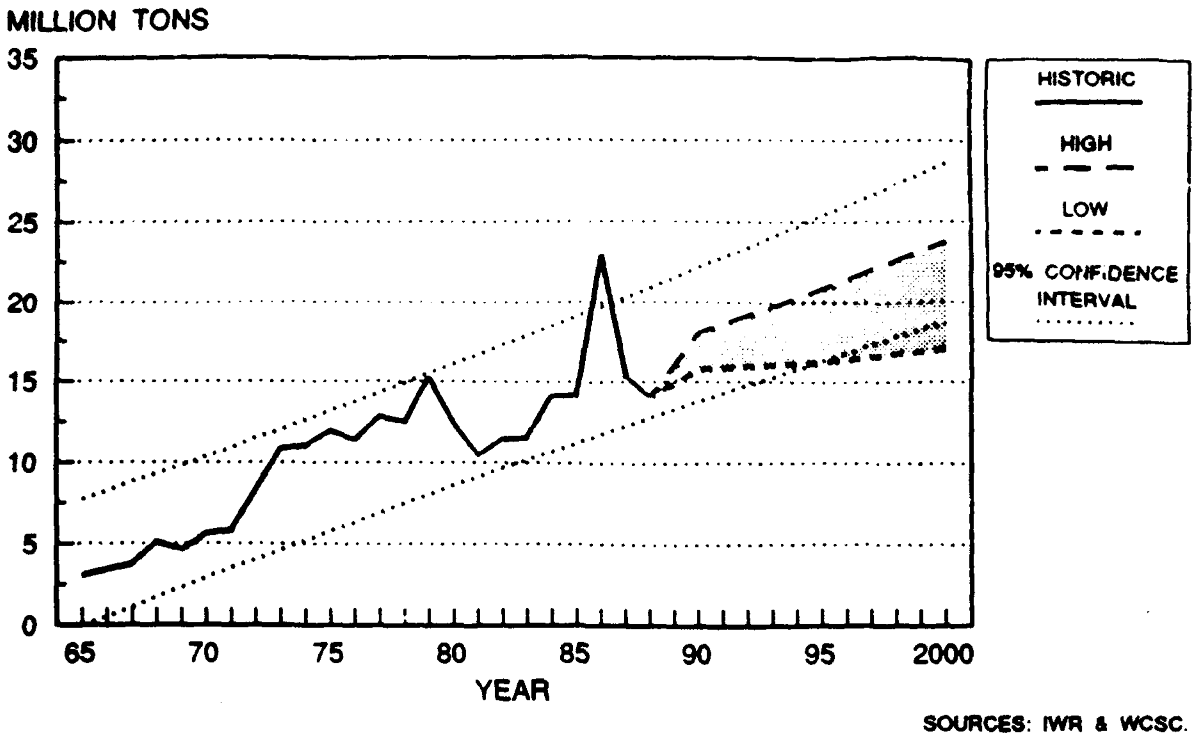


FIGURE 25: SEGMENT 5 - CUMBERLAND RIVER TRAFFIC
HISTORIC AND PROJECTED: 1965-2000

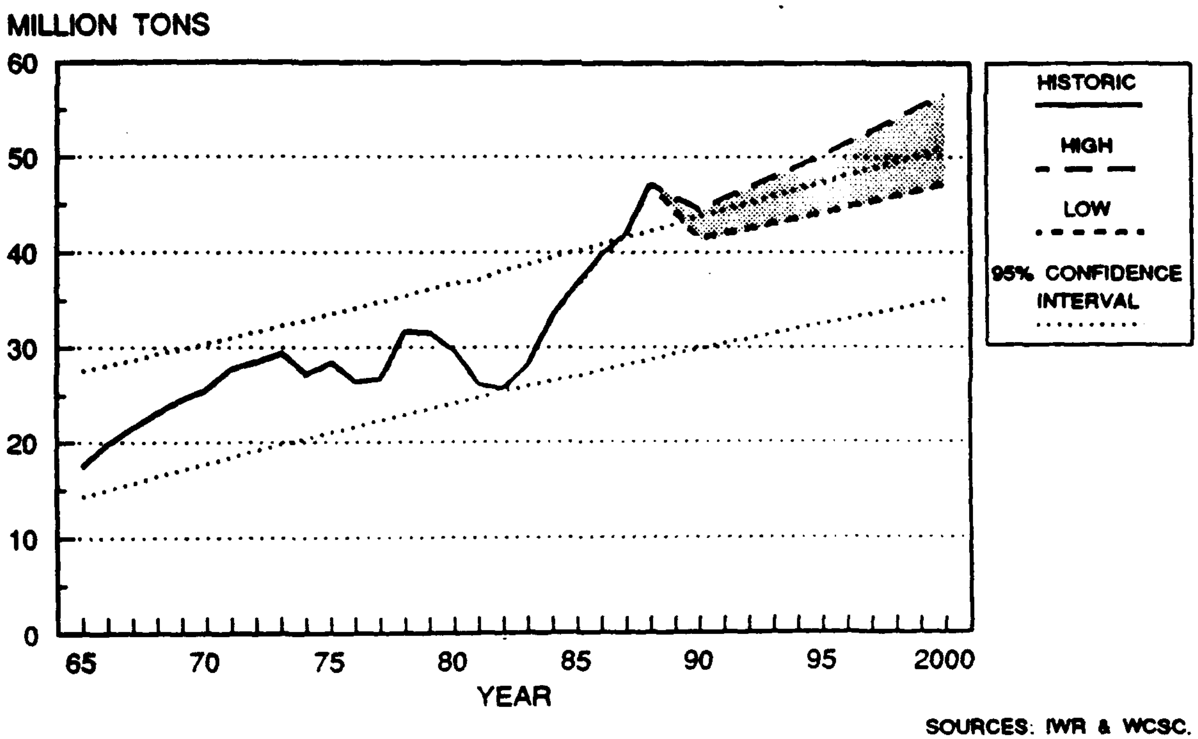


FIGURE 26: SEGMENT 5 - TENNESSEE RIVER TRAFFIC
HISTORIC AND PROJECTED: 1965-2000

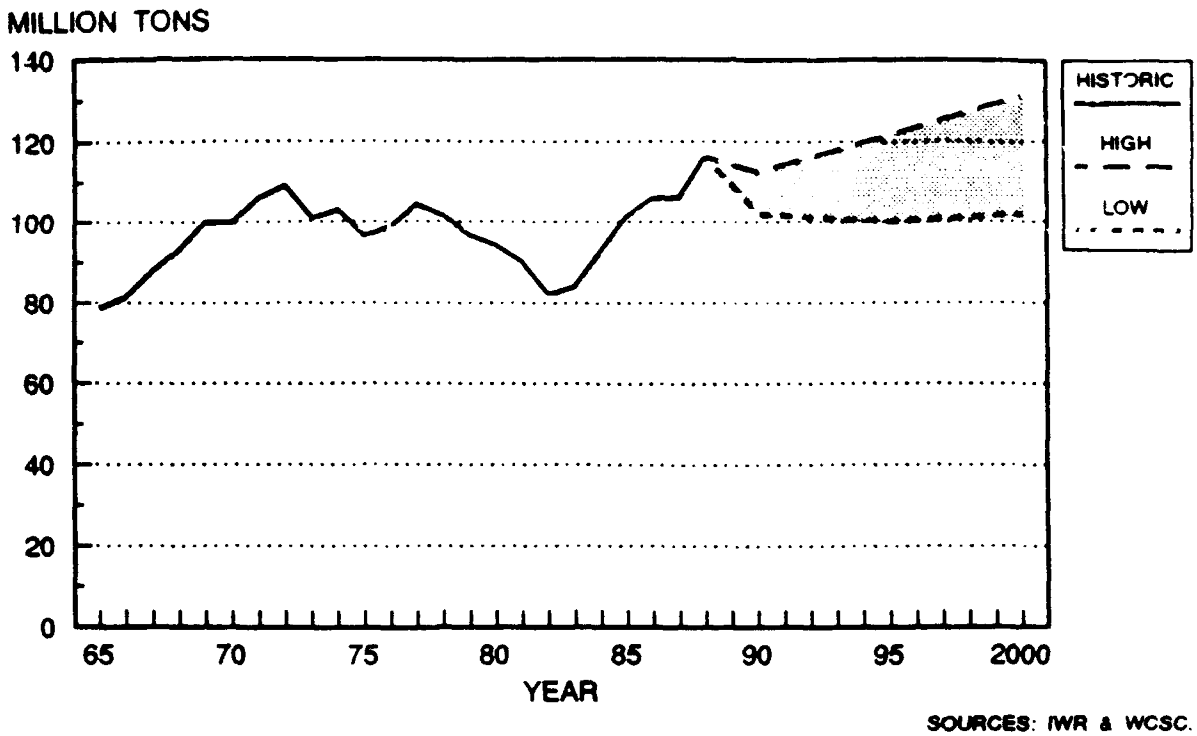


FIGURE 27: SEGMENT 6 - GULF INTRACOASTAL WATERWAY TRAFFIC
HISTORIC AND PROJECTED: 1965-2000

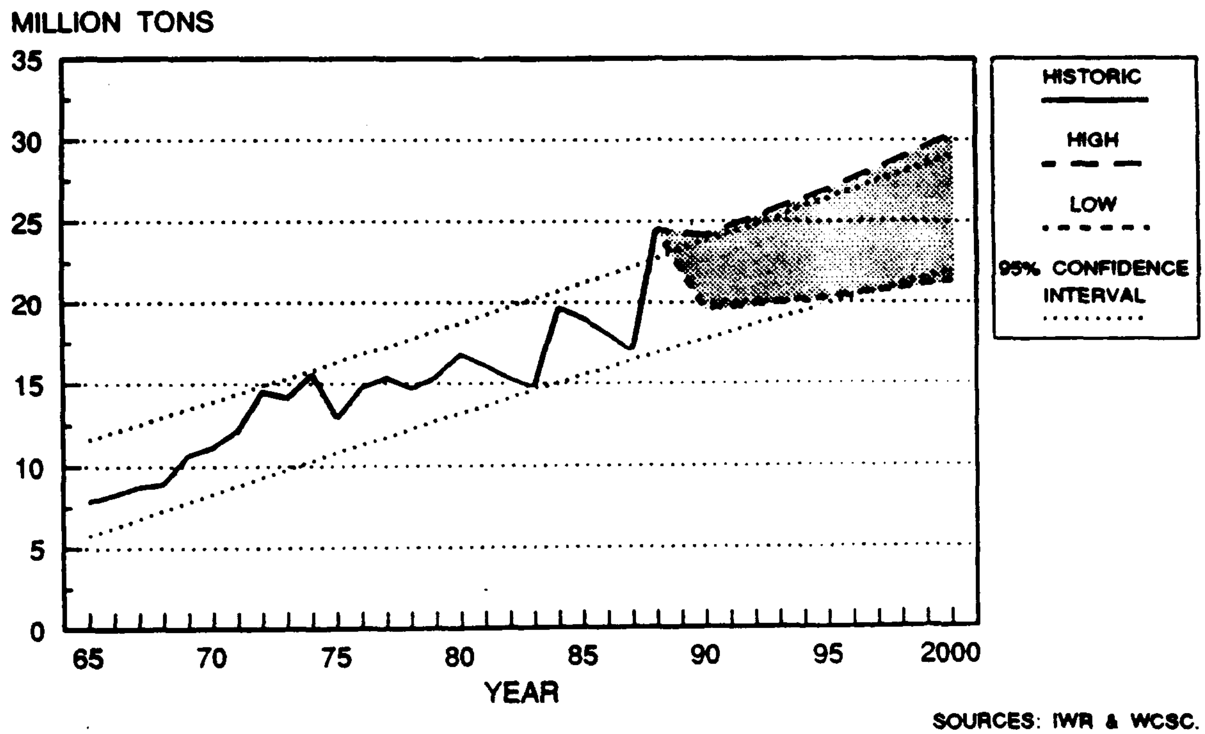


FIGURE 28: SEGMENT 7 - BLACK WARRIOR/TOMBIGBEE WW TRAFFIC
HISTORIC AND PROJECTED: 1965-2000

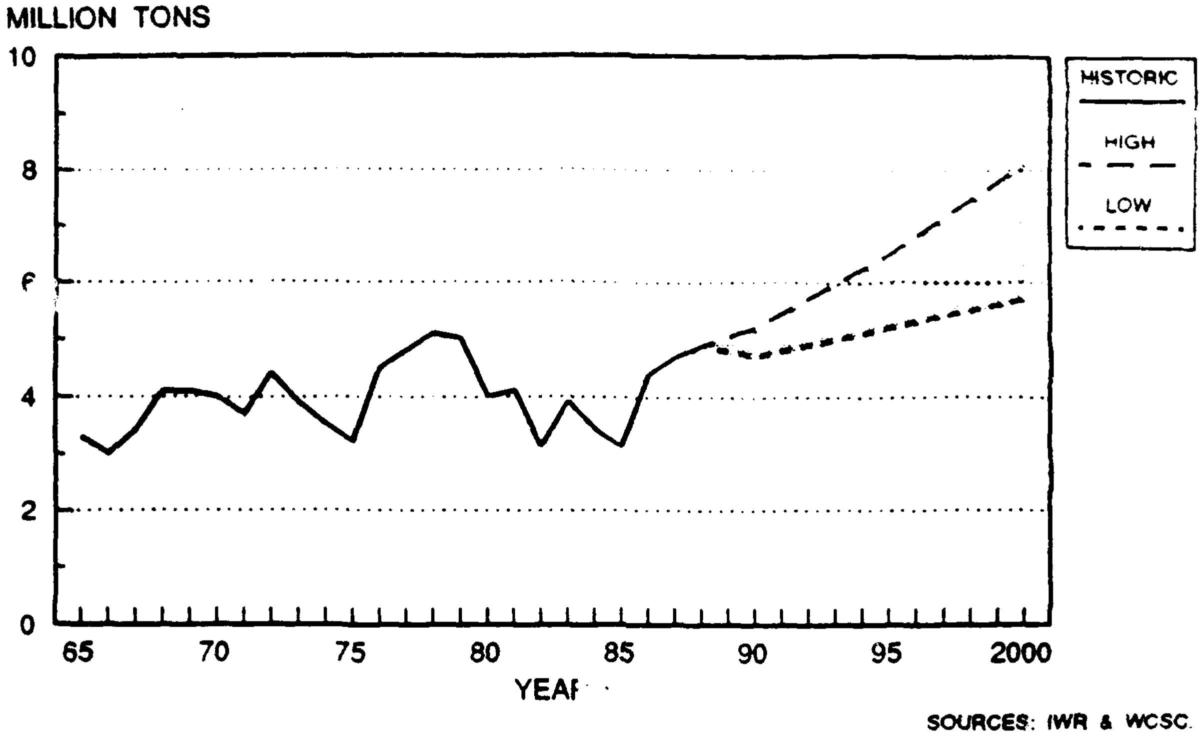


FIGURE 29: SEGMENT 8 - ATLANTIC INTRACOASTAL WW TRAFIC
HISTORIC AND PROJECTED: 1965-2000

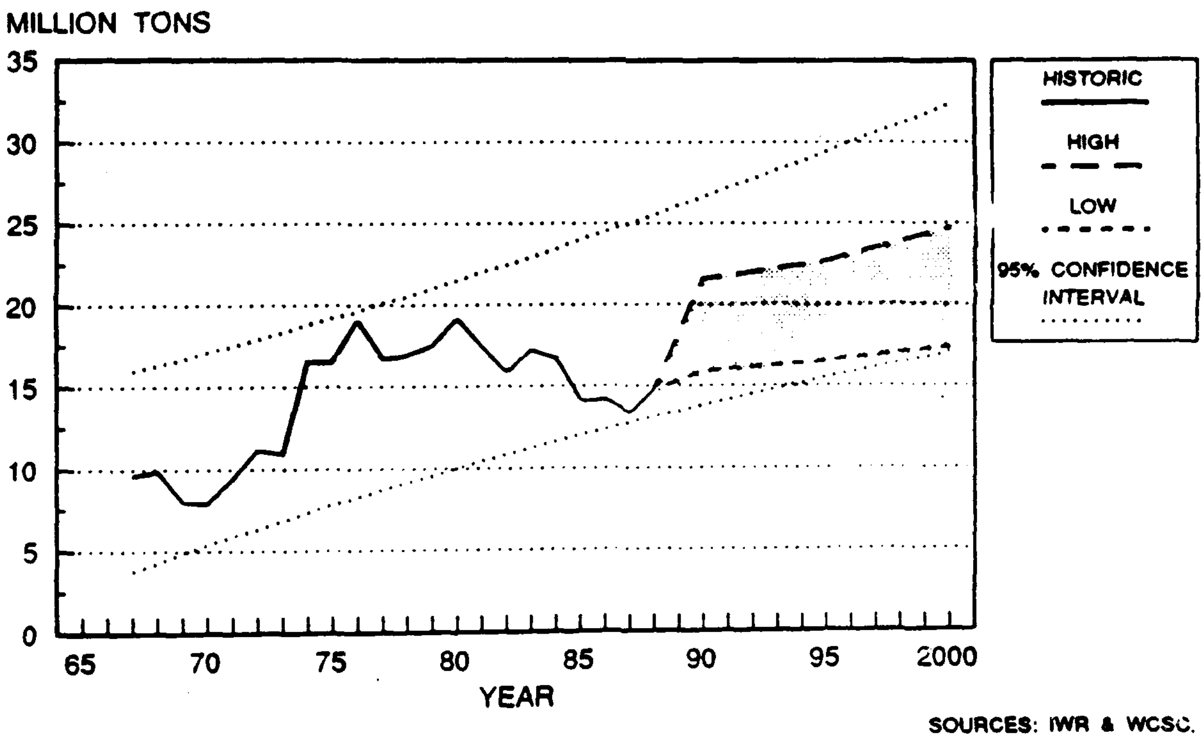


FIGURE 30: SEGMENT 9: COLUMBIA RIVER TRAFFIC
HISTORIC AND PROJECTED: 1965-2000

manufacturing industries, increased energy conservation, and reduced coal and grain exports. Renewed growth in traffic volumes began in 1984 stimulated by economic recovery and extremely low barge rates. The recovery in waterway traffic faltered briefly in 1985 as coal and grain traffic fell, but since has increased each year through 1990. More competitive exports due to the falling value of the U.S. dollar, relatively lower petroleum prices and agricultural export enhancement programs have stimulated domestic industrial activity and increased farm exports. However, farm products declined by four million tons in 1990.

Several important commodity groups comprise the vast majority of tonnage moving on the inland waterways as can be seen in Figure 14 and Table 20. The major commodities and their share of 1990 traffic are coal (30%); crude petroleum and petroleum products (27%); farm products (13%); nonmetallic minerals and products (12%); and industrial and agricultural chemicals (7%). A mixture of other commodities, including forest products, metallic ores, products and scrap, and a variety of specialty cargos comprise the remainder.

Coal traffic has varied over the past decade from a low of less than 115 million tons in the miners' strike year of 1978, to nearly 185 million tons in 1990, the highest level ever on the inland waterways. Growth has been significant since 1983 when economic recession and reduced coal exports resulted in inland waterway coal traffic of less than 126 million tons. The 1990 tonnage increased 18 million tons over 1989.

Farm products traffic on the inland waterways reached its peak at the national level in 1982, when over 85 million tons moved on the system, driven by rapid growth in U.S. grain exports. These grain exports began to fall by 1983 due to the high value of the dollar, increased competition from other nations, and intense European Community (EC) subsidization of their farm sector which turned the EC from net importers into net exporters. By 1986 farm products traffic on the inland waterways had fallen to 67.6 million tons, the lowest level since 1979. However, the introduction of grain export subsidies to compete with those of the EC, the falling value of the U.S. dollar in general, and reduced crop yields in some countries (USSR, China, India) combined to stimulate grain exports in 1987, 1988, and 1989. Total wheat, corn and soybean exports increased to 120.7 million tons in 1989. Total wheat , corn, and soybean exports from the United States declined to 95.9 million tons in 1990, then increased slightly to 100.2 million tons in 1991.

Waterway traffic in crude petroleum and petroleum products increased in 1990 to 50.4 million tons and 118.2 million tons, respectively. Crude had peaked in 1972 at 60.4 million tons before falling to a low of 34.7 million tons in 1982. While crude movements have grown each year since then, the declining domestic production is expected to blunt this trend over the next few years. Inland waterway movements of petroleum products peaked in 1977 at nearly 128 million tons, but fell each year after that to a low of less than 99 million tons in 1983, reflecting the combined effects of lower overall demand, increased conservation, the downturn in the economy, and greater reliance on pipeline transportation. Traffic in petroleum products is expected to grow slowly in the 1990's.

Chemical traffic on the inland waterways has generally grown since the recession period of 1982. Industrial chemicals increased each year from 23.2 million tons in 1982 to a new peak of nearly 38 million tons in 1988, then declined to 34.7 million tons in 1989 and 31.3 million tons in 1990. Agricultural chemicals, sensitive to fluctuations in the farm sector, peaked in 1986 at 12.8 million tons, then fell to 11.3 million tons in 1990. A stronger domestic economy in the 1990s and increasing exports for both chemical groups should result in renewed growth.

TABLE 20. U.S. INLAND WATERWAY TRAFFIC TOTAL COMMODITY MOVEMENTS, 1975 - 1990

(THOUSAND TONS)

COMMODITY GROUP	1965	1970	1975	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
FARM PRODUCTS	22177	29246	46058	74679	78066	85266	84732	80006	70567	67565	79229	82935	83152	78981
METALLIC ORE & PROD	13275	14040	14033	15068	14812	8242	8835	12537	14128	14922	13354	15489	16630	20473
COAL	92425	110099	125337	131648	138812	131004	125811	154436	147119	163127	157868	161694	166760	184777
CRUDE PETROLEUM	41936	52603	47581	41577	35290	34663	35527	38664	40925	43913	41036	44993	45893	50364
NONMETALLIC MIN/PROD	63388	78043	72677	68566	58761	56272	59957	70253	75593	75231	75774	75811	73757	76347
FOREST PRODUCTS	19309	20334	23421	22174	18572	16449	15690	19141	17638	20073	20261	17423	18611	18840
INDUSTRIAL CHEMICALS	15881	23705	23792	28122	26977	23193	25315	28954	29556	32895	36544	37954	34668	31269
AGRI CHEMICALS	1879	5260	6475	9033	8095	7269	10509	12393	11225	12806	11697	12108	11705	11344
PETROLEUM PRODUCTS	78243	102686	109459	116735	111073	101921	98851	103521	100429	107463	109284	115401	121545	118207
ALL OTHER COMMODITIES	21011	36106	35099	27377	30211	31214	21905	22598	27478	22504	24895	24309	28687	11848
TOTAL	369616	472123	503932	534979	520669	495453	487132	542503	534658	560499	569942	588118	606006	618314

SOURCE: WATERBORNE COMMERCE OF THE UNITED STATES, ANNUAL

Among other commodity groups on the inland waterways, forest products traffic rebounded in 1986 and 1987 to over 20 million tons, the highest level since 1980, but has since declined to 18.6 million tons in 1990, principally due to a decline in rafted logs in the Pacific Northwest. Strong domestic and export demand for lumber, pulp, and other wood products should sustain growth in the wood products sector, particularly for waterways in the Southeast. The cyclical nonmetallic minerals and products group, sensitive to construction industry and public works trends, recorded tonnages over 75 million each year from 1985 to 1988--the highest levels since 1979, then declined to 73.8 millions tons in 1989 and increased to 76.3 million tons in 1990. Metallic ores, products and scrap, while below the historic peak of 17.8 million tons in 1979, recovered impressively from a recession low of 8.2 million tons in 1982 to nearly 20.5 million tons in 1990, a new high.

4.2.2 Projected Traffic

As can be seen in Table 21, total traffic on the inland and intracoastal waterways is projected to experience modest but steady increases under all growth rate assumptions. Yearly fluctuations in response to current economic conditions and the volume of coal and grain exports are, of course, inevitable. Recent projections do not reflect the optimism that was evident in the high growth rates that were forecast in the late 1970s and early 1980s, but they do anticipate modest sustained growth through the year 2000. In Table 21 the sums of individual commodity forecasts result in projected average annual growth rates for total traffic (using 1986 as the base year) ranging from 0.7% (low) to 1.5 (medium) and 2.1% (high). Forecasts for total internal waterway traffic in 2000 range from a low of 620.1 million tons to a medium of 686.6 and a high of 748.2 million tons.

The commodities with the highest forecasted growth rates are farm products, coal and industrial and agricultural chemicals. Farm products traffic is forecast to grow more slowly after the early 1990s, ultimately increasing 20 to 42% from 1990 to 2005. Coal traffic is expected to continue recent growth on the waterways, particularly later in the forecast horizon to meet increasing utility demands. Coal is expected to increase 15 to 37% from 1990 to 2000. These commodity groups are expected to grow at average annual rates of 1.3% to 3.1%. The two chemical groups are driven by both strong domestic and export demand. From 1990 to 2000 industrial chemicals are projected to increase 26 to 60%, while agricultural chemicals grow from 39 to 78%.

Forest products traffic is expected to grow modestly over the period at an annual rate of 0.9% to 1.9%. Petroleum products are projected to remain nearly flat under low scenario assumptions but grow at a moderate 0.7% to 1.2% under the medium and high scenarios, respectively, as economic growth coupled with relatively low real prices result in slow but steady increases in demand.

Traffic levels in metallic ores, products and scrap, nonmetallic minerals and products, crude petroleum, and the "all other commodities" categories are forecast to be generally flat or declining over the period, with average annual growth rates ranging from +1.2% to -3.3%.

4.3 WATERWAY SEGMENT TRAFFIC: HISTORIC AND PROJECTED

Sixteen portions of the inland and intracoastal waterways contained within 9 major waterway segments were analyzed. Highlights of their historic and projected traffic are discussed below and depicted in Figures 15-30. Waterways exhibiting significant positive linear trends are shown with a 95 percent statistical prediction interval about the historic data and projected to 2000. Actual projections may fall outside these bands depending on fluctuations of major commodity groups. Historic traffic for selected years

TABLE 21. U.S. INLAND WATERWAY TRAFFIC IN 1990 AND PROJECTIONS OF TOTAL COMMODITY MOVEMENTS, 1990-2010

(MILLIONS OF TONS)

TOTAL TRAFFIC	ACTUAL 1990	1990			1995			2000			2005			2010			ANN % TO 2010		
		LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
FARM PRODUCTS	[illegible]	81.6	93.1	86.9	87.9	93.1	[illegible]	[illegible]	102.3	112.0	[illegible]	112.4	123.1	109.9	123.5	135.2	1.3%	1.8%	[illegible]
METALLIC ORE PR & SCRAP	20.5	14.1	15.2	17.2	13.8	14.7	17.0	13.5	13.9	17.0	12.8	13.6	16.8	12.1	13.5	16.6	-1.1%	0.6%	[illegible]
COAL	184.6	175.9	180.2	194.8	193.2	[illegible]	216.0	212.3	231.1	252.5	227.2	250.6	[illegible]	243.2	271.7	317.2	1.9%	2.4%	3.1%
CRUDE PETROLEUM	50.4	35.4	37.2	39.7	28.8	33.7	37.0	26.3	32.7	34.5	24.1	29.9	33.5	22.0	27.3	32.5	-3.2%	-2.2%	-1.5%
NONMETALLIC MIN PROD	76.3	69.9	76.0	77.5	68.3	77.9	79.9	69.4	79.9	81.9	70.4	81.9	84.0	71.5	84.0	86.1	-0.3%	0.5%	0.6%
FOREST PRODUCTS	18.8	20.6	21.2	24.4	21.4	23.3	24.8	22.7	24.9	26.1	23.0	25.9	27.6	23.3	[illegible]	29.2	1.3%	[illegible]	[illegible]
INDUSTRIAL CHEMICALS	31.3	33.3	34.7	35.7	36.2	39.9	42.4	39.4	45.8	50.3	41.6	49.6	57.7	43.9	54.2	66.2	[illegible]	1.6%	2.6%
AGRICULTURAL CHEMICALS	11.3	12.3	12.9	14.4	14.2	15.0	17.2	15.7	17.4	20.1	15.9	18.7	21.7	16.1	20.1	23.4	1.3%	2.3%	3.0%
PETROLEUM PRODUCTS	118.2	107.6	113.0	116.8	108.3	115.4	122.2	108.7	117.8	127.1	110.9	[illegible]	131.6	113.1	126.3	136.3	-0.1%	0.4%	0.8%
ALL OTHER COMMODITIES	11.8	22.0	23.2	24.9	19.5	21.9	25.8	17.4	20.8	26.7	16.5	21.5	27.6	15.6	22.3	28.6	[illegible]	-0.4%	[illegible]
TOTAL	618.3	572.7	596.7	622.3	591.6	638.9	681.6	620.1	686.6	748.2	644.5	[illegible]	[illegible]	[illegible]	[illegible]	871.3	[illegible]	[illegible]	[illegible]

TABLE 22. U.S. INLAND WATERWAY TRAFFIC BY SEGMENT, SELECTED YEARS, 1965-1990

(MILLION SHORT TONS)

WATERWAY SEGMENTS	1965	1970	1975	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
UPPER MISSISSIPPI	37.8	54.0	63.1	68.8	68.5	76.3	74.5	74.7	84.1	81.8	72.0	73.7	81.6	82.0	79.4	85.1
MIDDLE MISSISSIPPI	41.5	58.3	71.5	79.2	80.3	92.8	92.2	90.5	98.7	103.6	92.7	97.7	104.5	106.1	101.8	107.0
MISSOURI R.	7.7	7.5	6.2	7.9	7.7	5.9	5.3	4.9	6.3	6.4	6.5	7.0	6.7	6.7	5.4	5.8
LOWER MISSISSIPPI	59.8	85.9	108.6	135.0	136.9	146.2	149.2	143.1	148.1	156.6	149.9	156.2	167.7	169.0	181.8	185.3
ARKANSAS R.	1.3	4.0	5.2	9.9	8.4	8.5	7.7	7.8	7.6	8.5	7.7	8.4	7.9	6.7	7.9	8.1
ILLINOIS WATERWAY	29.0	36.6	45.8	39.8	37.8	44.1	39.7	41.6	43.0	39.2	38.1	42.3	41.1	40.5	39.1	43.0
OHIO RIVER SYSTEM	NA	NA	171.4	177.6	194.8	179.3	181.9	174.0	171.2	202.2	203.9	222.2	226.7	225.9	238.4	252.5
OHIO R.	103.2	129.5	140.1	152.6	165.3	155.9	158.7	150.7	150.4	174.7	177.5	195.6	197.2	192.6	202.7	224.9
MONONGAHELA R.	38.8	42.2	37.3	31.7	38.2	34.3	32.1	28.8	26.5	34.5	28.8	29.5	32.9	37.2	38.4	37.8
KANAWHA R.	13.2	14.0	12.5	11.0	13.8	14.7	13.0	13.7	13.2	14.2	14.6	16.8	16.2	17.8	18.9	20.9
CUMBERLAND R.	3.0	5.6	11.9	12.4	15.2	12.3	10.4	11.4	11.5	14.1	14.2	22.9	15.3	14.0	13.3	13.7
TENNESSEE R.	17.4	25.5	28.3	31.6	31.4	29.4	26.0	25.5	28.0	33.2	36.5	39.6	41.7	47.1	43.1	44.8
GULF INTRACOASTAL WW	78.5	100.1	96.4	101.4	96.6	94.1	89.9	81.9	83.8	92.4	101.3	105.7	106.1	115.9	111.6	112.5
BLK WARRIOR-TOMBIGBEE	7.8	11.1	12.8	14.6	15.3	16.7	16.0	15.2	14.7	19.6	18.9	17.9	16.8	24.5	19.6	16.8
ATLANTIC INTRACOASTAL	3.3	4.0	3.2	5.1	5.0	4.0	4.2	3.2	3.9	3.4	3.1	4.4	4.7	4.9	4.9	4.5 b/
COLUMBIA R.	NA	7.8	16.5	16.9	17.4	19.1	17.3	15.7	17.1	16.6	14.0	14.1	13.2	14.6	17.2	13.0
TOTAL a/	369.6	472.1	503.9	534.5	535.0	535.0	520.7	495.5	487.1	542.5	534.7	560.5	569.8	588.1	606.0	618.3

SOURCE: *WATERBORNE COMMERCE OF THE UNITED STATES, ANNUAL*

NA NOT AVAILABLE PRIOR TO 1970
a/ TOTAL TRAFFIC IS NOT SUM OF COLUMNS; SUMMING WOULD RESULT IN "DOUBLE COUNTING."
b/ FINAL 1990 TONNAGE NOT YET AVAILABLE FOR THE ATLANTIC INTRACOASTAL WATERWAY, THIS FIGURE IS AN ESTIMATE.

TABLE 23. U.S WATERWAY TRAFFIC PROJECTIONS BY SEGMENT: LOW AND HIGH, 1990, 1995 AND 2000

(MILLIONS OF TONS)

SELECTED WATERWAY SEGMENTS	ACTUAL 1990	1990 LOW	1990 HIGH	1995 LOW	1995 HIGH	2000 LOW	2000 HIGH	GROWTH RATE[b] LOW	GROWTH RATE[b] HIGH
UPPER MISSISSIPPI	85.1	82.5	92.0	87.6	102.1	93.3	112.4	0.9%	2.3%
MIDDLE MISSISSIPPI	107.1	106.3	117.4	112.9	130.3	120.3	144.8	0.9%	2.2%
MISSOURI R.	5.8	6.8	7.6	6.5	8.5	6.2	9.4	-0.9%	2.1%
LOWER MISSISSIPPI	185.3	168.5	187.8	178.3	209.6	189.5	234.0	0.8%	2.4%
ARKANSAS R.	8.1	8.9	11.5	9.1	13.5	9.6	15.5	2.6%	6.2%
ILLINOIS WATERWAY	43.0	44.5	49.9	47.2	54.9	50.1	60.1	1.5%	2.9%
OHIO RIVER SYSTEM	252.5	232.3	254.2	248.2	288.1	266.8	327.0	1.2%	2.7%
OHIO R. - MAINSTEM	224.9	204.1	224.3	217.7	253.9	233.7	287.7	1.4%	2.9%
MONONGAHELA R.	37.8	38.5	42.1	40.5	48.6	43.1	56.2	1.1%	3.0%
KANAWHA R.	20.9	18.1	21.4	19.5	24.6	21.2	28.4	1.3%	3.4%
CUMBERLAND R.	13.7	15.7	18.0	16.2	20.8	17.0	23.7	1.3%	3.6%
TENNESSEE R.	44.8	41.3	44.4	44.0	50.1	47.1	56.6	-0.0%	1.3%
GULF INTRACOASTAL WW	112.5	102.0	112.4	99.9	121.3	101.7	131.0	-0.9%	0.9%
BLK WARRIOR-TOMBIGBEE	21.5	22.1	24.1	23.6	26.9	25.3	30.2	0.2%	1.5%
ATLANTIC INTRACOASTAL	4.5[a]	4.7	5.2	5.2	6.5	5.7	8.1	1.1%	3.7%
COLUMBIA R.	15.0	15.8	21.5	16.4	22.6	17.3	24.7	1.2%	3.8%
US TOTAL INTERNAL	618.3	572.7	622.3	591.6	681.6	620.1	748.2	0.4%	1.7%

a/ ATLANTIC INTRACOASTAL WATERWAY 1990 TRAFFIC IS ESTIMATED.
b/ GROWTH RATE USING 1986 BASE TRAFFIC. SOURCE FOR 1990 DATA IS WCSC.

PROJECTIONS CALCULATED BY CEWRC-IWR USING:

1) NATIONAL GROWTH RATES BY COMMODITY GROUP ADAPTED FROM DRI, WEFA, USDA, DOE, IWR. WATERWAY SEGMENT PROJECTIONS BASED ON AN AVERAGE SHARE OF COMMODITY TRAFFIC FROM NATIONAL PROJECTIONS, WHICH VARIED BY WATERWAY DEPENDING ON HISTORIC PATTERNS AND COMMODITY GROUP.

2) LINEAR ADJUSTED PROJECTIONS CALCULATED BY ADDING THE DIFFERENCE (POSITIVE OR NEGATIVE) BETWEEN THE ORIGINAL BASE AND THE LINEAR ADJUSTED BASE TO EACH PROJECTED NUMBER. LINEAR ADJUSTED BASE IS 1986 CALCULATED VALUE USING LINEAR TREND ANALYSIS FOR 1965-1986 DATA BY WATERWAY AND FOR THE NATIONAL TOTAL. ONLY SELECTED WATERWAYS WERE CALCULATED BECAUSE OF A LACK OF DATA OR BECAUSE HISTORIC DATA EXHIBITED NO LINEAR RELATIONSHIP OVER TIME.

3) TREND PROJECTIONS BASED ON LINEAR REGRESSION ANALYSIS OF TIME SERIES TONNAGES FROM 1965-1986, AND ARE ONLY SHOWN FOR THOSE SEGMENTS WHICH DISPLAYED A LINEAR RELATIONSHIP OVER TIME.

4) FOR WATERWAYS WITH NONLINEAR HISTORIC DATA OR INCOMPLETE DATA, TWO STANDARD DEVIATIONS OF THE HISTORIC DATA WERE CALCULATED. THIS RANGE WAS THEN APPLIED TO MEAN VALUES OF THE HIGH AND LOW PROJECTIONS TO GENERATE NEW PROJECTIONS FOR THE YEAR 2000. INTERMEDIATE PROJECTIONS WERE THEN INTERPOLATED.

5) THESE WATERWAY PROJECTIONS ACCOUNT FOR THE MAXIMUM RANGE OF FORECASTS, LOW TO HIGH, CALCULATED BY USING ALL OF THE ABOVE TECHNIQUES.

between 1965-1990 on these segments and subsegments is shown in Table [illegible] while 1990-2000 projected tonnages are in Table 2[illegible]. The Ohio River, the L[illegible] and the Middle Mississippi, and the Gulf Intracoastal Waterway (GIWW) historically have carried the highest volumes of waterborne commerce. These waterways are followed in tonnage by the Upper Mississippi, the Tennessee and the Illinois Rivers.

4.3.1 Upper Mississippi River

Total tonnage rebounded on the Upper Mississippi River from low levels in 1985 and 1986 to 85.1 million tons in 1990 (Figure 15). Farm products traffic increased by 13.5 million tons between 1986 and 1990 due to renewed strength in U.S. grain exports. Petroleum products increased to 10.8 million tons after declining to a low of 9.2 million tons in 1984. Coal, on the other hand, declined for the fourth year in a row to 8.7 million tons, down from a 1986 peak of 11 million tons. Crude petroleum continued a long decline, dropping to the lowest level since 1975.

Traffic projections for the Upper Mississippi are driven by recovery and growth in farm products traffic in particular (53% of total), as well as increases in coal and industrial and agricultural chemicals. Total traffic is projected to increase from 85.1 million tons in 1990 to between 93.3 and 112.4 million tons by 2000. Farm products movements are forecast to continue to grow, as U.S. grain exports continue to recover world market share. Coal traffic is also projected to continue to grow at a moderate rate in the future. Industrial and agricultural chemicals are both expected to continue moderate growth rates, while petroleum products show flat to modest increases in traffic.

4.3.2 Middle Mississippi and Missouri Rivers

The Middle Mississippi carried a record 107 million tons in 1990, up by over 14 million tons from 1985 (Figure 16). Farm products movements, representing 50% of the total, were down from 1988, but up over 13 million tons from the 1985 low point. Coal, the next largest commodity group, peaked in 1986 at 21.5 million tons. Tonnage in 1990 was 17.8 million tons. Industrial chemicals exceeded 4 million tons for the fifth year in a row. Metallic ores, products and scrap also exceeded 4 million tons, indicating new strength in this industrial sector since the 1982 recession year low of 2.3 million tons.

Projections of traffic on the Middle Mississippi are for moderate growth from 107 million tons in 1990 to between 120.3 and 144.8 million tons by 2000. Farm products and coal will continue to be the dominant commodities. Farm products and coal are the driving forces in the projections and account for most of the growth. Petroleum products show little or no growth.

Traffic on the Missouri River increased .4 million tons to 5.8 million tons in 1990. This is still down from the 7 million tons in 1988 and 7.9 million tons in 1979. This poor performance is due to a continuing slide in farm products traffic (Figure 17). Nonmetallic minerals and products represented 81% of total Missouri River traffic in 1991.

Missouri River projections are for slow growth during the remainder of the century, increasing to 6.7 or 9.4 million tons, under the low and high scenarios, respectively. However, historic fluctuations on this segment suggest traffic also could decline. Traffic on this waterway is depressed by the high percentage of nonmetallic minerals and products, which is projected to show little or no growth at the national level. Unreliability of water levels and seasonal closure also dampen growth potential on the Missouri.

4.3.3 Lower Mississippi and Arkansas Rivers

The Lower Mississippi carried a record of over 185 million tons in 1990, a gain of almost 35 million since 1985 (Figure 18). The Lower Mississippi has sustained nearly steady traffic growth over the past decade, increasing at an average annual rate of 4.7% since 1975. Tonnage is dominated by farm products (40% in 1990), followed by coal (21%) and nonmetalic minerals (11%). Coal tonnage grew continuously from 1982 through 1986, then declined slightly in 1987 and 1988. Coal tonnage in 1990 was 38.2 million tons, a new record. Non metallic minerals and metallic ores products and scrap also had growth in 1990, while petroleum products declined.

Projections for the Lower Mississippi anticipate relatively strong growth through 2000 from increases in farm products, industrial and agricultural chemicals, coal, and, under the high scenario, petroleum products. Tonnage is forecast to increase from 185 million tons in 1990 to between 189.5 and 234 million tons in 2000.

Tonnage on the Arkansas River increased to 8.1 million tons in 1990, up from 6.7 million tons in 1988; the record was 9.9 million tons in 1978 (Figure 19). Persistent low water problems on the White River portion of the McClellan-Kerr were exacerbated by severe drought during 1988, hampering the interchange of traffic with the Lower Mississippi. The traffic increases in 1989 and 1990 were largely due to larger farm products and nonmetallic minerals movements. Traffic on the Arkansas is mostly farm products and petroleum, agricultural chemicals, nonmetallic minerals and products and petroleum products. Petroleum products, 23% of total traffic when it peaked at over 2 million tons in 1977, has since declined to under 1 million tons in 1990.

Tonnage on the Arkansas River is projected to grow from 8.1 million tons in 1990 to between 9.6 and 15.5 million tons in 2000. Farm products, agricultural chemicals and nonmetallic minerals and products continue to dominate traffic on the waterway. Agricultural chemicals increase by 50% under the high scenario by 2000.

4.3.4 Illinois Waterway

Traffic on the Illinois Waterway peaked at 45.8 million tons in 1975. It began to falter in the late 1970s and into the recession years of the early 1980s as the traditional heavy industries of this region fell on hard times (Figure 20). Increasing farm products traffic helped offset declines in traditional smoke-stack commodity groups of coal, petroleum products, metallic products and scrap, and industrial chemicals. Total tonnage in 1990 was 43 million tons, up 3.9 million tons from the previous year.

Projections of traffic on the Illinois Waterway anticipate moderate growth through 2000. Total tonnage is expected to increase from 43 million tons in 1990 to between 50.1 and 60.1 million tons by the turn of the century. Strong growth in farm products, coal, and industrial chemicals account for most of the projected growth on the Illinois.

4.3.5 Ohio River System

The Ohio River System (the main stem and its navigable tributaries) has shown dramatic traffic growth in recent years, passing 200 million tons in 1984 and over 252 million tons in 1990 (Figure 21). This total tonnage figure is 48% higher than the recession year low of 171 million tons in 1983. Coal has generally accounted for 55-65% of total Ohio River System traffic over the past decade, and an even higher percentage on some of the tributaries. It has

been the principal commodity pulling up tonnages from recession period lows, creating growth rates relatively higher than national averages for the Ohio System (an annual rate of 3.9% since 1981). Growth in farm products traffic has also been significant since the mid-1970s. (Figures 22-26 show historic and projected traffic on the Ohio and its tributaries.)

Strong growth has occurred on the main stem of the Ohio River, up nearly 27% between 1985 and 1990 to 224.9 million tons. Traffic in farm products, coal, and metallic ores and products increased from 1988.

Projections of traffic on the Ohio River System reflect modest sustained growth under all scenarios through 2000. Total traffic on the system is projected to increase from 252.5 million tons in 1990 to between 266.8 and 327.0 million tons by 2000. On the main stem traffic is expected to increase from 225 million tons in 1990 to between 233.7 and 288.7 million tons by 2000. Coal continues to be the primary commodity and assumptions about the share of coal traffic moving on the waterways drive the differences in tonnage between the low and high scenarios.

Total tonnage on the Monongahela had been recovering steadily from depressed levels in the mid-1980s, growing 31% from 28.8 to 37.8 million tons between 1985 and 1990. Total tonnage on the Monongahela is expected to increase from 37.8 million tons in 1990 to between 43.1 and 56.2 million tons by 2000 (87% coal).

Traffic on the Kanawha increased 43% between 1985 and 1990, growing from 14.6 to 20.9 million tons (77% coal). Traffic on the Kanawha is projected to grow from 20.9 million tons in 1990 to between 21.2 and 28.4 million tons by 2000, with coal continuing to constitute about 75% of the total.

Record high traffic on the Cumberland in 1986 reflected a temporary diversion of tows around Kentucky Lock on the Tennessee River while it was undergoing major rehabilitation. Total Cumberland tonnage in 1990 was 13.7 million tons, up about .4 million tons from 1989. Cumberland River traffic is also forecast to have moderate increases, with coal and nonmetallic minerals comprising the largest commodity shares. Total traffic is expected to increase from 13.7 million tons in 1990 to between 17 and 23.7 million tons by 2000.

Tennessee River traffic has exhibited strong growth since the 1981-82 recession period, increasing from 25.5 million tons in 1982 to 44.8 million tons in 1990. This was down from the record high 47.1 million tons in 1988. Some of the increase on the Tennessee in 1988 was due to drought-induced diversion off the Mississippi to the Tennessee-Tombigbee Waterway. Coal makes up the bulk of the traffic; 1990 coal traffic was 21.9 million tons, or 49% of the total. The Tennessee River is forecast to show moderate growth through 2000, driven mainly by coal, farm products and chemicals. Tonnage is forecast to increase to between 47.1 and 56.6 million tons by 2000. However, recent higher than expected growth on this river could cause totals to exceed current projections.

4.3.6 Gulf Intracoastal Waterway

The Gulf Intracoastal Waterway ranked third in tonnage in 1990 after the Ohio and the Lower Mississippi Rivers. Record traffic on the waterway reached nearly 116 million tons in 1988, but declined to about 112.5 million tons in 1990. This volume of traffic demonstrated a strong recovery from the 1982 low of 82 million tons when oil shocks followed by recession had taken a major toll in GIWW traffic (Figure 27). Petroleum products dominate GIWW traffic, reaching a new high of 44.6 million tons in 1989 (40% of the total), and declining slightly in 1990 to 41.9 million tons (37% of the total).

Forecasts for the GIWW range from an overall decline in traffic under the low scenario (to 101.7 million tons in 2000) to moderate growth under the high projection (to 131 million tons in 2000). This variation is due to the waterway's high proportion of crude petroleum and petroleum products, commodities for which traffic projections can be particularly volatile. The projections were adjusted to take into account the historic fluctuations in traffic volume. Crude is projected to decline at varying rates under all scenarios, while petroleum products range from nearly flat growth under the low to modest growth under the high scenario. Moderate to strong growth is projected for industrial chemicals and coal. The current strength of industrial chemicals and petroleum products may result in higher than projected traffic in 1991, but in the longer term growth is expected to level off as chemical plants run at or near capacity.

4.3.7 Black Warrior/Tombigbee Waterway

Traffic on the Black Warrior/Tombigbee Waterway jumped significantly to 24.5 million tons in 1988 from 14.7 and 16.8 million tons in 1983 and 1987 respectively. Diversion of traffic from the drought stricken Lower Mississippi accounted form much of the 1988 growth (Figure 28). However, 1990 traffic declined to 16.8 million tons. The current growth commodity on the waterway is forest products, which amounted to 4.5 million tons in 1990. As recently as 1983, only about 233,000 tons of forest products were moving on the system, but the opening of new processing plants and increasing export demand for pulp and wood chips have stimulated tremendous growth since then. Movements of metallic ores, products and scrap for the steel industry collapsed between 1976 and 1982. Economic recovery and the restructuring of the industry has resulted in a partial rebound of this traffic.

Projections of traffic on the Black Warrior/Tombigbee Waterway show moderate growth through 2000 from higher coal and forest products movements. Some of the liquid chemical and petroleum products traffic gained during the drought is expected to remain on the safer slackwater Tenn-Tom and Black Warrior system. In the longer term total traffic is forecast to increase from 16.8 million tons in 1990 to between 25.3 and 30.2 million tons by 2000. Coal traffic recovers strongly under high scenario assumptions, generating most of the traffic growth. Recent rapid growth in forest products movements quickly matures in the near term and grows more slowly in out years.

4.3.8 Atlantic Intracoastal Waterway

Final tonnage data for 1990 on the Atlantic Intracoastal Waterway were not yet available at publication. However, traffic grew significantly in 1989 to 4.9 million tons, up from 3.1 million tons in 1985. The generally upward trend in recent years is due primarily to sharply higher, but localized, movements of agricultural chemicals and nonmetallic minerals and products, particularly along the North Carolina coast. Industrial chemicals and agricultural chemicals both achieved new highs in 1989. Petroleum products and forest products have shown on long-term decline since the late 1970s (Figure 29).

Projections of traffic on the AIWW anticipate continued strength in agricultural chemical movements, dominated by localized movements to Morehead City, N.C. for both domestic use and export. Total traffic on the waterway is expected to increase from 4.9 million tons in 1989 to between 5.7 and 8.1 million tons in 2000. Of this total about 4 million tons is projected to be agricultural chemicals. The projection envelope has been adjusted to account for historic wide fluctuations on this waterway.

4.3.9 Columbia River

The Columbia River transported 13.0 million tons in internal (shallow draft) waterborne commerce in 1990. This was a 4.2 million ton decrease from 1989 and well below the 1980 peak of 19.1 million tons. Lower forest product movements account for much of the decline in total tonnage since 1980, particularly rafted logs. Farm products and forest products make up the major volume shipped on the Columbia River.

Projections for this waterway anticipate a recovery in traffic as movements of farm and forest products for export regain their former strength. Total waterway traffic is forecast to grow from 13.0 million tons in 1990 to between 17.3 and 24.7 million tons by 2000. Forest products increase significantly by 2000, due to exports to the Far East market, but remain below tonnages achieved in the mid-1970s. Farm products are projected to increase to levels near or slightly above the traffic volume during peak grain export years of the early 1980s by the year 2000 (Figure 30).

4.4 SUMMARY

Despite a major drought which disrupted traffic in 1988, total internal waterborne commerce in 1990 reached record levels and reflected the strength and continued growth of the economy from the recession years of the early 1980s. The recent recovery in grain exports, the continued strength of coal, the vigorous growth in petroleum products, industrial and agricultural chemicals, and metallic ores, products and scrap indicate that inland waterway traffic has resumed its long term growth trend. The nation's economic growth, and increased exports due to the weak dollar and for grain - incentive programs, led to increased traffic for farm products and petroleum products and higher levels of crude petroleum products movements in the late 1980s.

Projections of inland waterway traffic are tied to the general well being of the economy as well as the changing fortunes of various commodity groups and to the competitiveness of the barge industry. However, generally modest growth is expected across all waterways over the next decade, as evidenced by the 1.5% annual growth rate under the medium scenario.

Farm products traffic will continue recent gains due to grain export enhancement programs, particularly affecting traffic on the Illinois and the full length of the Mississippi. Longer term projections for farm products traffic are uncertain due to the policy element, but modest growth should continue through the turn of the century due to the food demands of a growing world population.

Coal traffic is expected to experience modest growth in the near term as steel industry demand remains flat, and export demand faces continued strong foreign competition. The net impact of the 1990 Clean Air Act on the overall movements of coal still is unclear. Coal traffic is likely to grow more slowly than it has in recent years, but may return to a higher growth rate later in the 1990s, affecting traffic on the Ohio River System, the Black Warrior/Tombigbee, and Middle Mississippi and Illinois rivers in particular.

Despite recent increases, probable longer term declines in domestic petroleum production will result in a reduction in traffic in crude petroleum and a slower growth rate for petroleum products, affecting total tonnages on such waterways as the Gulf Intracoastal and the Lower Mississippi.

In general, however, all waterways benefit to some extent from renewed positive growth on the inland and intracoastal waterway system.

CHAPTER 5
SYSTEM NEEDS ASSESSMENT

5.1 INTRODUCTION

The inland waterway system has evolved by authorization and construction of waterway segments. Most of the waterway segments were planned and are operated in the context of multiple purposes. These may include flow regulation to reduce flood damages and to increase minimum flows for water quality, fish and wildlife or other beneficiaries, hydropower production from available head and water flow, withdrawal of water for irrigation and/or municipal and industrial water supply, and for recreation by boating, picnicking, camping and other uses. Most of the inland navigation system also serves wild fowl migration and other habitat objectives.

As the inland navigation system has matured, improvements in barge/towboat technology coupled with increasing traffic has resulted in rebuilding parts of the system to provide for more economical water transportation by larger tow units. Lock geometry now plays a very important role in passing larger tows with few delays. Lock approach and exit flow conditions can expedite lock approach and exit times for tow/barge units and lock sizes are being standardized to facilitate 8 barge tows in 110' x 600' locks and 17 barge tows in 110' x 1200' lock chambers. A significant portion of the Ohio River Mainstem system was upgraded in the 1960's and 1970's from 110' x 600' chambers to 110' x 1200' main chambers and 110' x 600' auxiliary chambers in high lift locks, based on the authority contained in the 1909 Flood Control Act to replace locks and dams. When L&D 26 replacement under this authority was proposed, a policy decision was made that restricted the 1909 authority to replacement in kind, i.e., a 110' x 600' lock chamber could be repaired only by a 110' x 600' chamber at the existing project location. Subsequently, each specific lock and dam being proposed to replace existing locks with larger lock chambers and a new alignment are approved by specific Congressional authorization based on a feasibility study with a Chief of Engineers report which recommends replacement. Following the mandates and policies resulting from the National Environmental Policy Act of 1969, a full environmental impact statement is developed as part of each feasibility report.

From a system point of view, authorization of individual locks are often implied to be a system commitment to improve other locks (especially by waterway segment). Consideration for obtaining authorization for sets of locks can bring broader considerations to bear and establish a program level commitment and schedule to system improvements. The Inland Waterways Users Board (IWUB), established by the Waterway Resources Development Act of 1986, is acting to bring more focused attention to the investment needs in the inland waterways system. This may lead to a more strategic process of waterway improvement authorization decisions.

5.2 PROJECT EVALUATION CRITERIA

The Corps follows the procedures required by the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G). Projects are formulated and evaluated to maximize net national economic development benefits and to satisfy all applicable environmental laws and standards. In the case of inland navigation projects the benefits are primarily those reductions in transportation costs which would accrue to shippers choosing barge transportation over alternative modes. When locks become congested, a major part of transportation cost reduction benefits come from reduction in delays. Benefits are estimated using system models which account for net delays on each shipment throughout the inland navigation system with and without capacity addition at the project

being studied. Project costs include those costs due to mitigation of adverse impacts on fish and wildlife habitat caused by project construction, operations (dredging and other activities), and commercial navigation tows transiting the waterways. There may be other benefits and costs attributed to the project which are included in the analysis.

Each feasibility study undergoes a rigorous review by the Corps, other Federal agencies, States and State agencies, and the public. A favorable Chief of Engineers' Report is conditioned by the issues developed during the review process and the adjustments in project costs and benefits brought about by the review process. Chief's reports are favorably transmitted by the Secretary of the Army's Office, if the project meets the objectives of the Administration's Legislative Program and then the Congress acts on the proposed authorization. At this time, several reconnaissance and feasibility studies are underway. A summary of ongoing studies is presented in Chapter 6.

5.3 WATERWAYS PLANNING PROCESS

The interaction of the Inland Waterway Users Board (Users Board) and the Corps has led to a series of assessment reports by the Corps. The objectives are: (1) to sort out all relevant claims for investment on the Fuel Taxed Inland Waterways System (those segments on which the fuel tax is paid by waterway operators); (2) to progressively improve estimates of benefits and costs of the various measures; and, (3) to develop potential schedules for each action in the context of projected funds which will be available in the Inland Waterways Trust Fund. The WRDA of 1986 authorized seven inland navigation projects on the Fuel Taxed System, escalated the fuel tax in increments to 20¢ per gallon in 1995, established the principle of 50% cost sharing of construction costs from the Trust Fund in each project authorized, and created the Users Board to oversee the Trust Fund and to make recommendations on priorities for use of the Trust Fund. The Corps investment needs studies were designed to help the IWUB reach decisions about investment priorities. Some initial results of these studies prepared for the March 1992 meeting of the Inland Waterways Users Board are presented in Table 1 in Appendix C.

In FY90, a test of economic assessment of 38 lock and dam projects (screened from the regional studies) was conducted to test the methodology assessing the General Equilibrium Model (GEM) developed by the Lower Mississippi Valley Division of the Corps of Engineers. The test was successful and provided the basis for replacement of the input data and assumptions during FY91. A report was given to the IWUB.

In FY91, an assessment was made of the 38 projects with consistent estimates of lock capacity and traffic forecasts. The analysis included evaluation of small scale capital improvement measures.

<u>Trust Fund Capability</u>. The Inland Waterways Trust Fund receives revenues from a fuel tax paid by towing companies operating on the Fuel Taxed System. The Trust Fund was authorized in FY78 as part of the decision to proceed with construction of two new locks and a dam at L&D 26 (Upper Mississippi River near Alton, Illinois). The Fuel tax collection started in FY81, and the rate has been increased from 4¢ per gallon in steps to the current 15¢ rate, and will increase to 20¢ per gallon in 1995. Figure 31 shows the receipts from fuel taxes and interest on the Trust Fund balance from 1981 to 1996. Fuel taxes are projected to be slightly over $100 million in 1995.

The Water Resources Development Act of 1986 (WRDA 86) authorized eight inland waterway locks/dam projects, and two more projects were authorized later to draw 50 percent of the outlays for construction and engineering and design work. Eight of these projects are now under construction. Figure 32

shows the buildup in outlays for construction from the Trust Fund. Figure 33 shows the impact of this construction on the balance in the Trust Fund. Under current schedules, the balance will be drawn down to a point where construction schedules for additional new start projects will be affected by trust fund capability by the end of this decade. The scheduling for the program will be controlled by trust fund income and will likely be capable of funding three or four new projects each decade. One problem with fuel taxes is that they are not elastic with respect to inflation, although project costs are. If no adjustments in the fuel tax are made or no new sources of revenue obtained, the replacement rate will gradually slow and the fuel taxed system will age at an increased rate.

Utilization of Lock Capacity. Assuming the eight projects under construction become operational, an analysis of the impacts of projected waterway traffic on available capacity in the 38 projects most likely to be candidates for new lock chambers was made by a Corps Task Force. Traffic projections are midrange of the growth trends now available and are in the range of slightly more than 2% per year. Figures 34-37 show the utilization of available capacity, projected traffic and traffic which can economically transit the system. The difference between projected traffic and equilibrium traffic is diverted to other transport modes because traffic congestion produces delay costs which result in diversion of traffic from the waterways.

Further insight into the challenges of funding high priority investment projects can be found by study of the trust fund analysis developed by the Corps for each Inland Waterways Users Board meeting. The latest analysis (March 1992) is in Appendix C (Tables 1 and 2). An excerpt which describes the Users Boards' recommended priorities from the most recent (1991) Annual Report is presented in Appendix D. In general, the Users Board has recommended acceleration of the studies now underway of the Upper Mississippi River System and a pacing of construction projects to fit available funding and Corps construction capability. Some slowing of certain projects is also recommended.

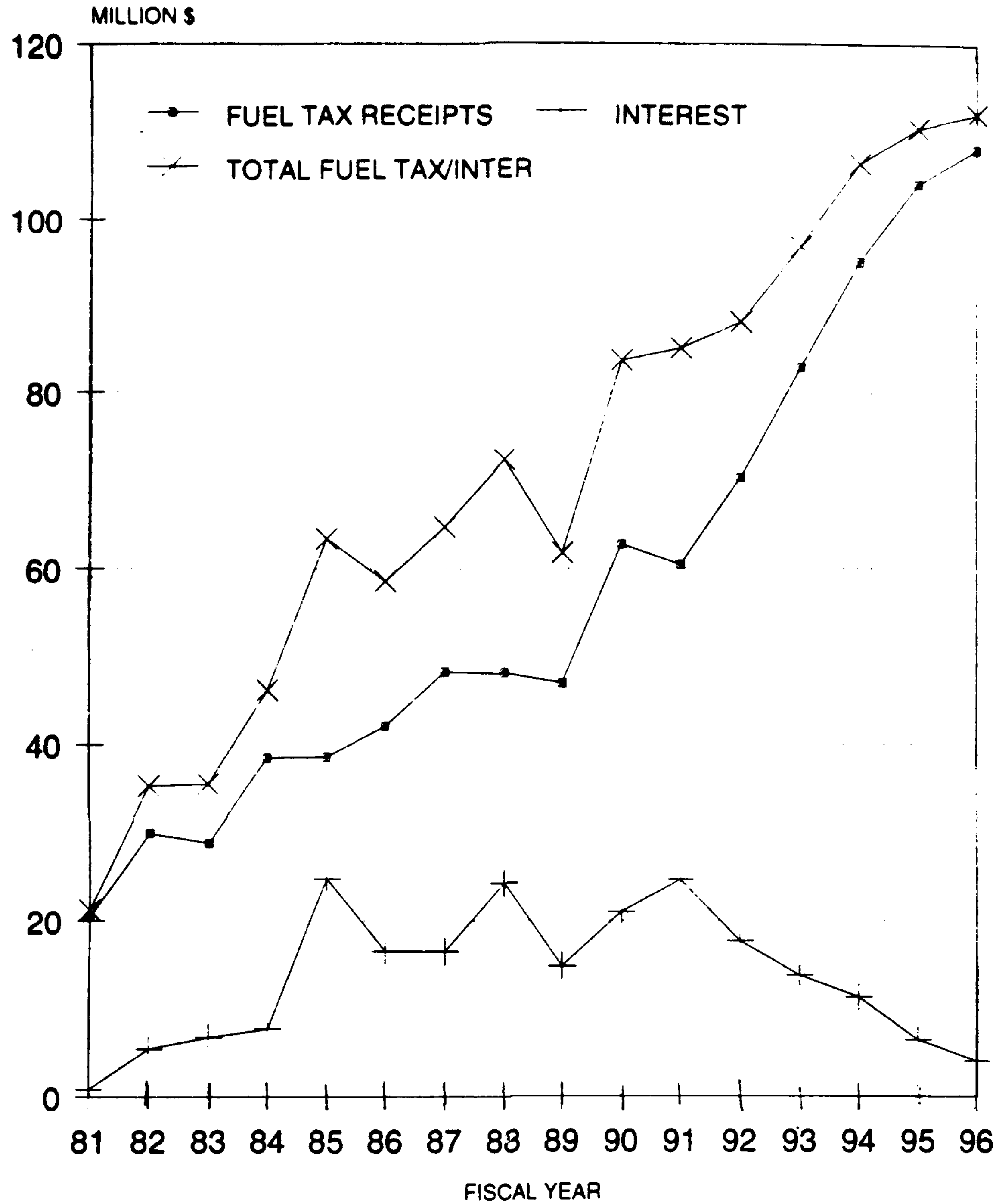


FIGURE 31: INLAND WATERWAYS TRUST FUND, 1981-1996

* Estimated fuel tax revenues will be slightly over $100 million at 20 cents per gallon in 1995.
* Interest earned will be very low.
* Fuel taxes revenue will grow slowly (about 1 1/2% per year)

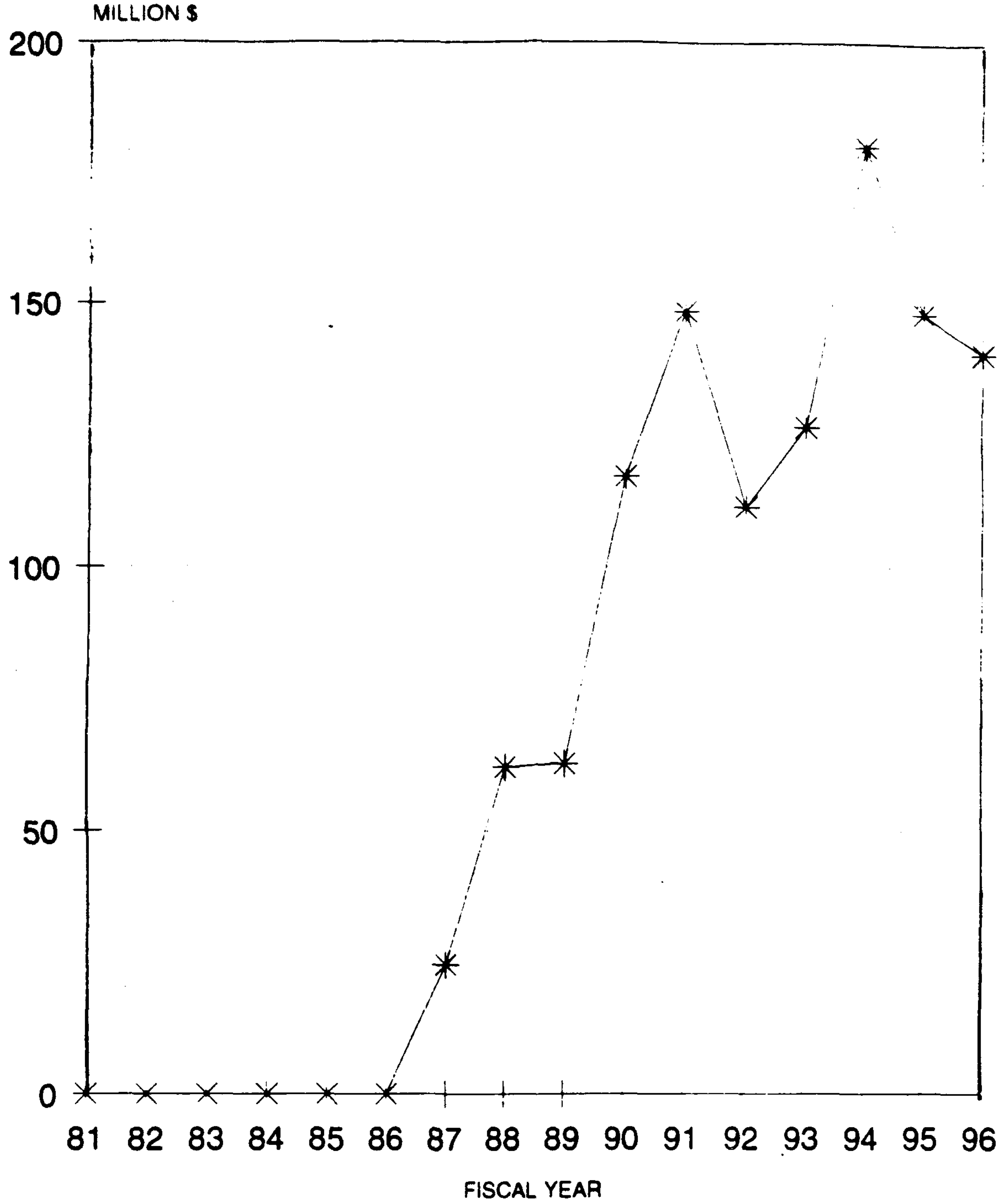


FIGURE 32: INLAND WATERWAYS TRUST FUND OUTLAYS, 1981-1996

* Outlays exceed income in FY91 and continues.

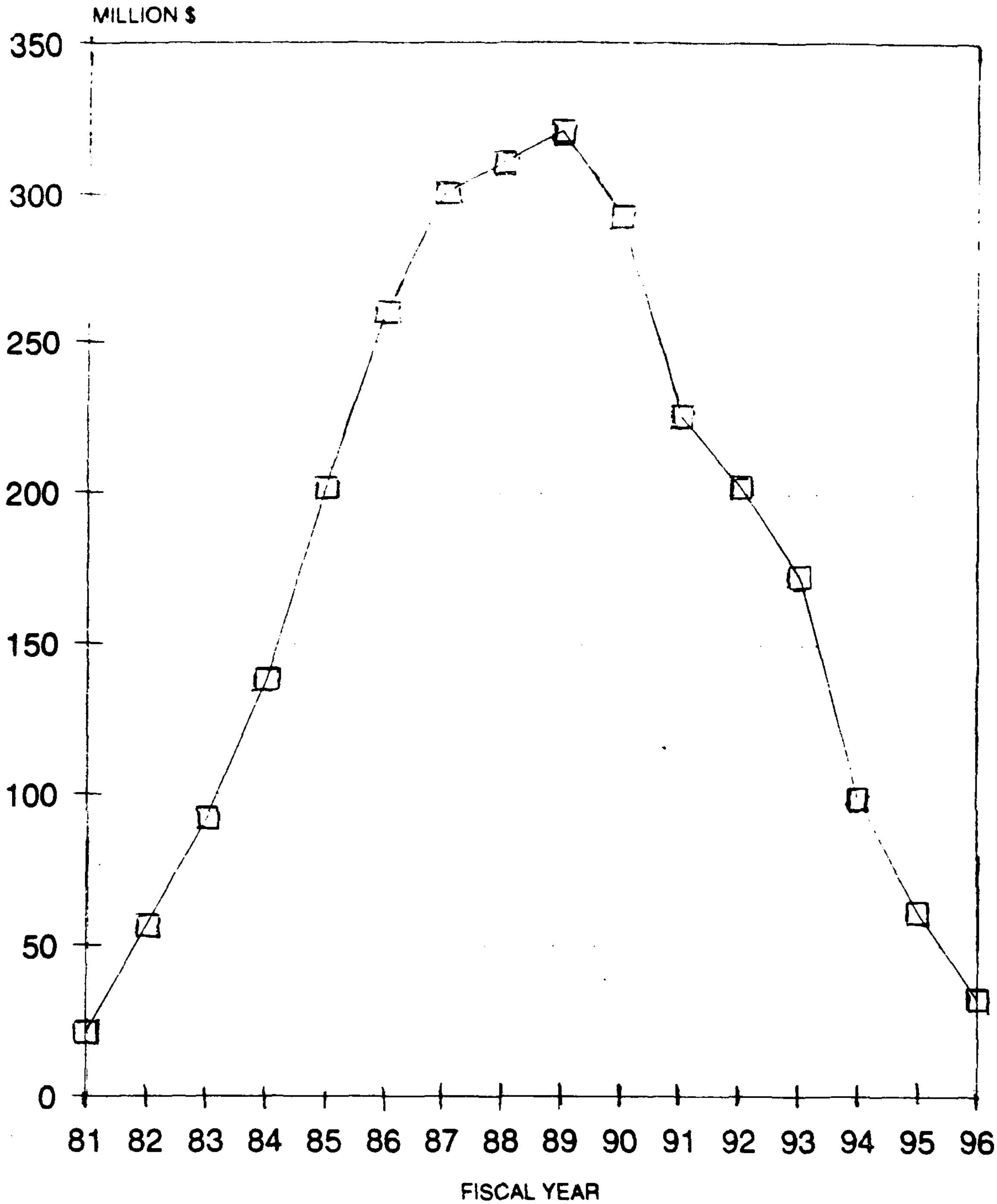


FIGURE 33: INLAND WATERWAYS TRUST FUND BALANCE, 1981-1996

* The cushion inherited when WRDA 86 authorized 7 projects is being eliminated.

* The pace of investment in inland waterways will be controlled by fuel tax reciepts.

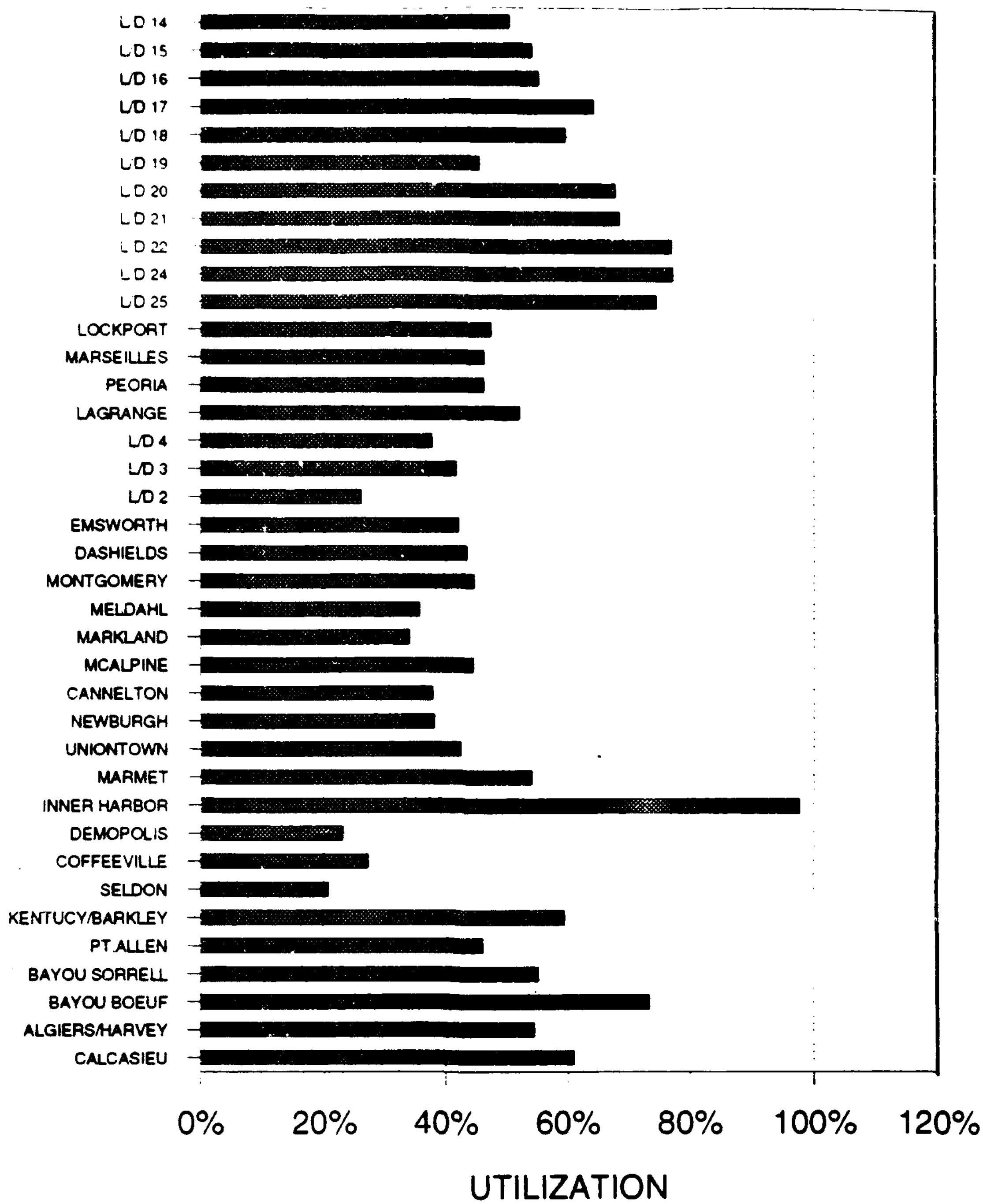


FIGURE 34: UTILIZATION OF EXISTING CAPACITY, BASED ON 1987 ACTUAL TRAFFIC

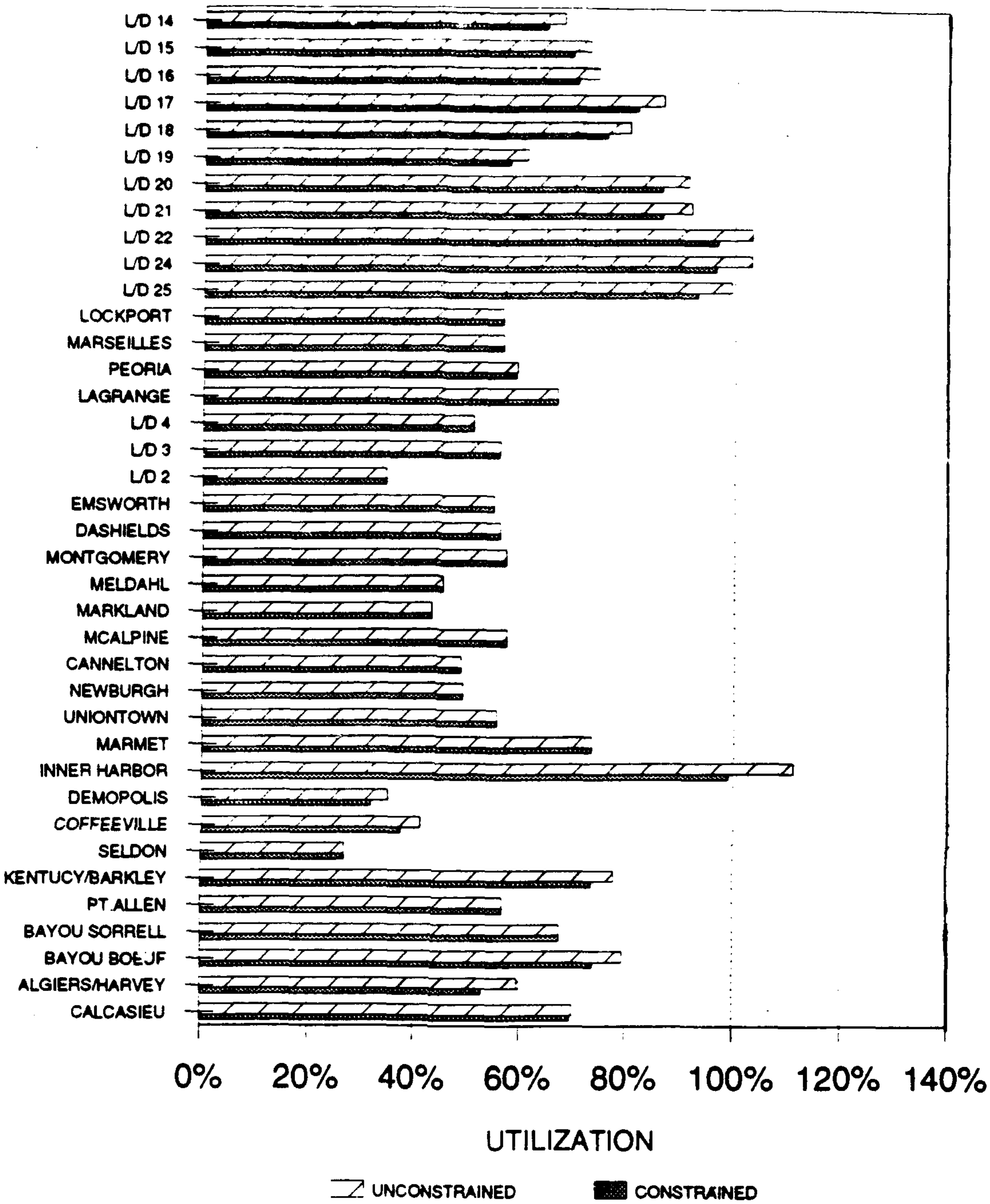


FIGURE 35: UTILIZATION OF EXISTING LOCK CAPACITY, BASED ON YEAR 2000 TRAFFIC PROJECTIONS

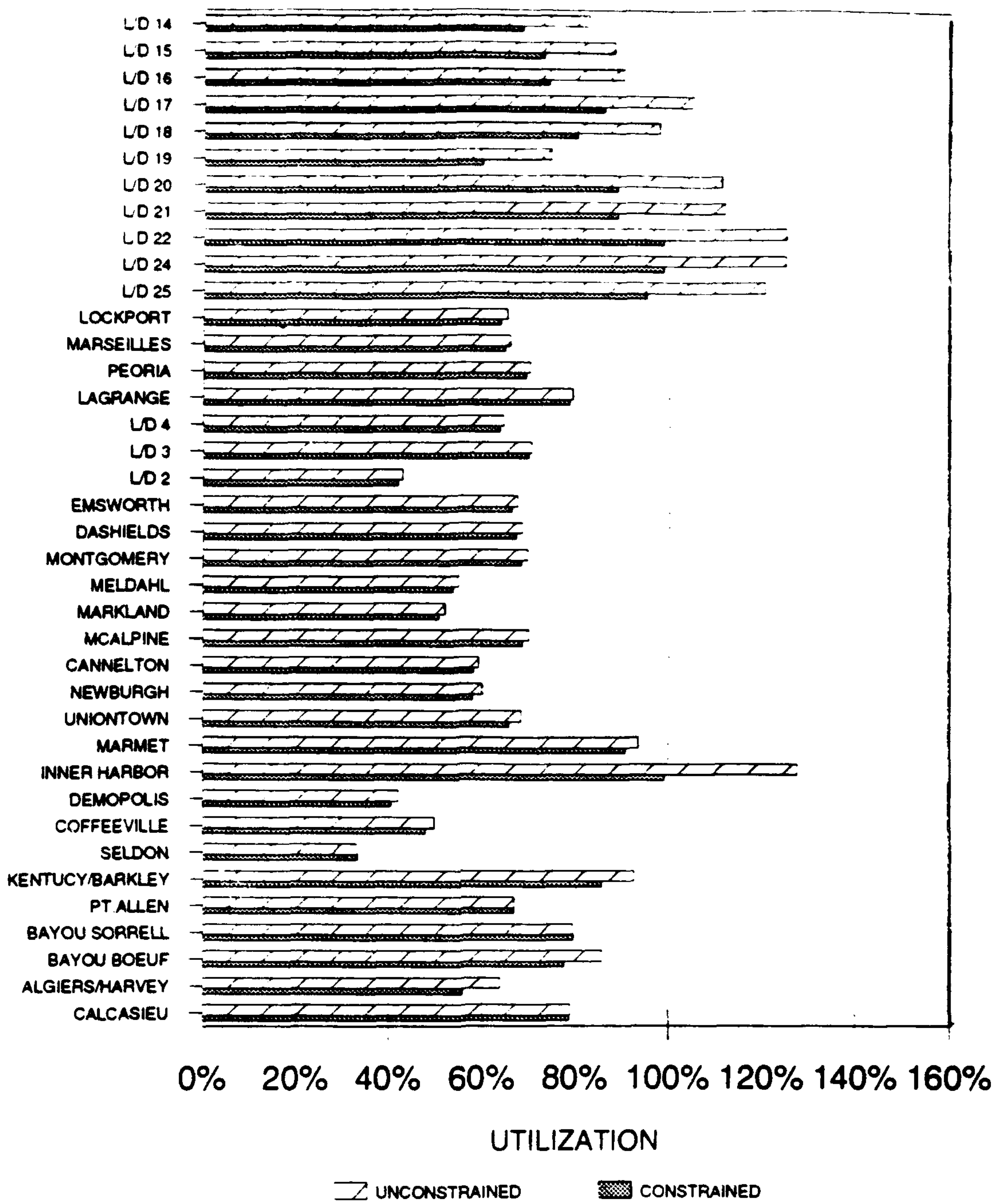


FIGURE 36: UTILIZATION OF EXISTING LOCK CAPACITY, BASED ON YEAR 2010 TRAFFIC PROJECTIONS

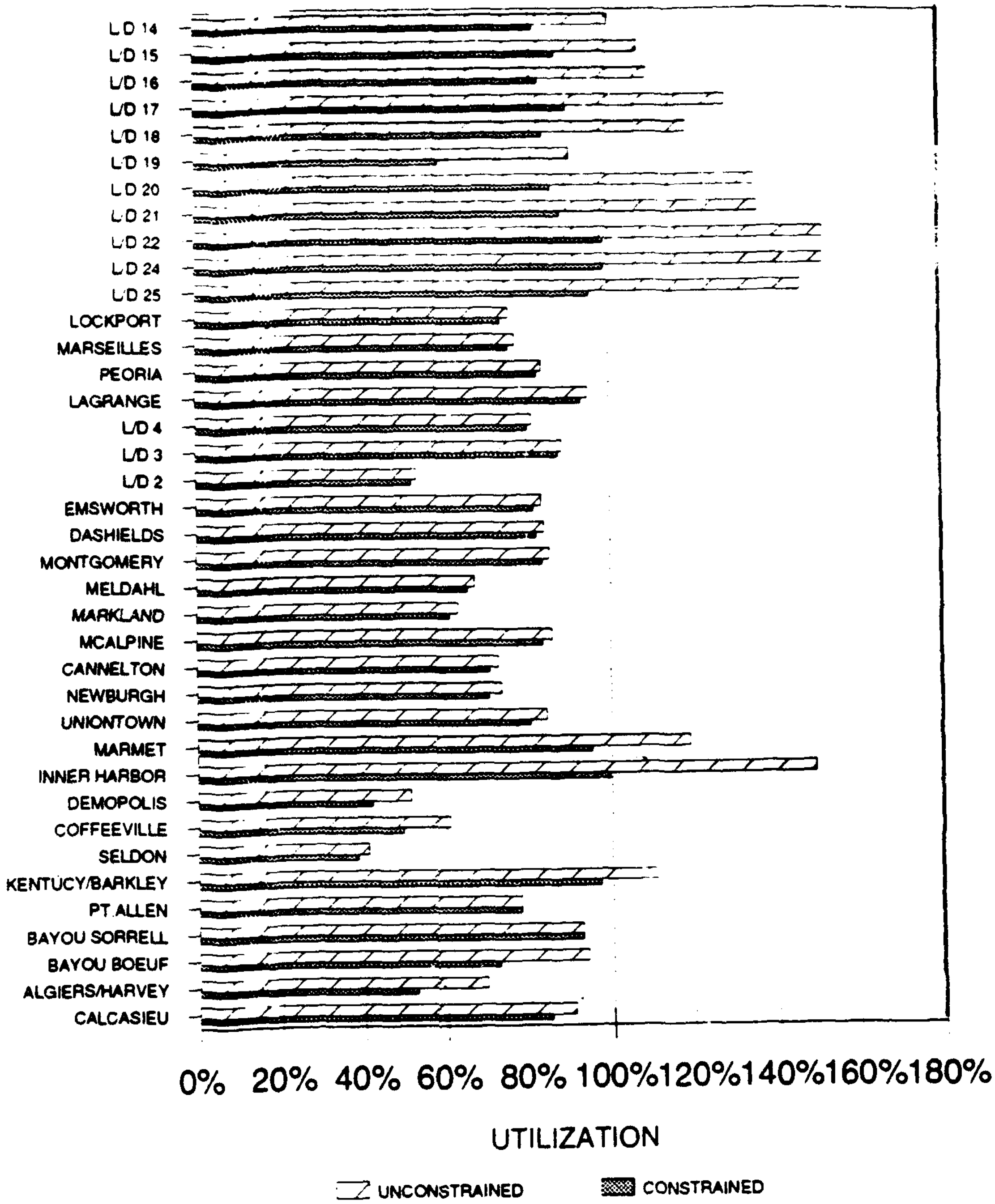


FIGURE 37: UTILIZATION OF EXISTING LOCK CAPACITY, BASED ON YEAR 2020 TRAFFIC PROJECTIONS

CHAPTER 6
WATERWAY PROGRAMS AND FUNDING

6.1 INTRODUCTION

This chapter describes the Corps of Engineers activities for operation and improvement of the waterways system, in terms of expenditures. Corps activities account for most of the Federal government participation in the system. Expenditures are shown by type of activity and by waterway.

The past decade's inland navigation investment program, as reflected by the combined construction and operation and maintenance (O&M) appropriations for waterway projects declined from about $645 million in FY 1980 to $595 million in FY 1986 before sharply recovering and reaching $954 million in FY 1991 (Table 24). The initial decrease is being reversed during the late 1980's and early 1990's as the Red River Waterway and lock and dam projects authorized in 1986 and 1988 are being built. Construction investment fell about 50 percent from about $425 million in FY 1980 to $220 million in FY 1987, but has climbed back to nearly $530 million in FY 1991. O&M almost doubled from $220 million in FY 1980 to $426 million in FY 1991. Consequently, the relative positions of O&M and construction spending reversed, with O&M commanding almost two-thirds of the waterways investment compared to one-third in 1980. In 1991 construction gained a 50/50 split due to its 140 percent surge in funding over the last four years.

The waterways share of civil works funding between 1980 and 1991 declined, and then revived from 27 percent to 40 percent as the total program witnessed a recent, sharp increase overall in construction and a steady rise in O&M. Construction's share of the program dropped from about 65 to 45 percent. Waterways' share of construction funding has risen more erratically from 26 percent in 1980 to 46 percent in 1991. It dipped to only 18 percent in 1987. The waterways share of O&M funding is 25 percent compared to 23 percent in 1980, but it reached 31 percent in 1989.

6.2 OPERATIONS AND MAINTENANCE

Historically, about 85 percent of all shallow draft navigation operations and maintenance costs have been expended on fuel taxed waterways. O&M costs for fuel taxed waterways have increased by 107 percent in current prices to about $388 million during the twelve year period ending in 1990 (Table 25). During the same period ton-miles of traffic rose 35 percent. The nominal cost per ton-mile increased from 1.0 mill in FY 1977 to 1.6 mills in FY 1990.

High traffic volume waterway segments generally have lower O&M costs per ton-mile than segments with low traffic volume (Table 25 and Figures 38, 39, and 40). Overall O&M costs averaged 1.6 mills per ton mile in FY 1990, and ranged from an average of .6 mills for the Lower Mississippi to about 29 mills per ton-mile for the AIWW/IWW. Four segments (Lower Mississippi, Middle Mississippi, Ohio, and GIWW) have low O&M costs per ton-mile of 0.6 to 1.8 mills. The Ohio and Lower Mississippi segments have the largest O&M outlays, together accounting for almost half of the costs.

TABLE 24. FEDERAL INLAND WATERWAYS AND CIVIL WORKS INVESTMENT 1980-1991

(Millions of Dollars)

Inland Waterways				Civil Works			
Fiscal Year	Const $	O&M $	Total $	Const. $	Inland %	O&M $	Inland %
1980	427	220	647	1660	26	942	23
1981	422	242	664	1594	26	968	25
1982	432	249	681	1430	30	1025	24
1983	359	296	655	1508	24	1201	25
1984	314	321	635	927	34	1185	27
1985	301	338	639	948	32	1308	26
1986	254	339	593	880	29	1260	27
1987	218	392	610	1149	18	1390	28
1988	267	418	685	1200	22	1455	29
1989	307	438	745	1180	26	1433	31
1990	392	382	774	1084	36	1426	27
1991	528	426	954	1143	46	1522	28

SOURCES: USACE, CECW-BD, U.S. Army Corps of Engineers Appropriations for Civil Works, January 1990, for Civil Works funds. (O&M amount for FY1988-1990 includes Regulatory Functions.) USACE FY Civil Works Justification Data Congressional Submission for waterways construction allocations. USACE Navigation Cost Recovery Data Base System for O&M expenditures.

NOTE: This includes all projects on fuel taxed waterways and includes amounts from the Inland Waterways Trust Fund for construction and from the Harbor Maintenance Trust Fund for O&M.

TABLE 25. SUMMARY OF ACTUAL COST OF OPERATIONS AND MAINTENANCE FOR THE INLAND WATERWAYS SUBJECT TO FUEL TAX, 1977-1990

SEGMENT	O&M COSTS ($Million) 1977	1982	1990	TON-MILES (Million) 1977	1982	1990	O&M COSTS PER TON-MILE ($/Ton-Mile) 1977	1982	1990
1 UPR MISS	25.9	38.9	85.4	11380.5	14630.2	16972.5	0.0023	0.0027	0.0050
(% of Total)	14%	16%	22%	6%	7%	7%			
2 MDL MISSS	17.5	14.3	27.3	14018.1	16800.6	18889.9	0.0012	0.0009	0.0014
(% of Total)	9%	6%	7%	8%	9%	8%			
3 LWR MISS	50.4	61.8	71.1	75369.1	89578.6	111422.9	0.0007	0.0007	0.0006
(% of Total)	27%	25%	18%	42%	46%	46%			
4 ILLINOIS	9.2	13.0	18.0	8046.6	7808.9	8513.7	0.0011	0.0017	0.0021
(% of Total)	5%	5%	5%	4%	4%	3%			
5 OHIO	42.8	59.5	92.7	45528.6	44916.6	62837.9	0.0009	0.0013	0.0015
(% of Total)	23%	24%	24%	25%	23%	26%			
6 GIWW	22.8	33.9	37.0	19820.1	16397.8	20641.5	0.0012	0.0021	0.0018
(% of Total)	12%	14%	10%	11%	8%	8%			
7 MOBILE	7.5	16.2	36.5	4671.1	4741.3	2572.7	0.0016	0.0034	0.0142
(% of Total)	4%	7%	9%	3%	2%	1%			
8 AIWW/IWW	8.6	7.9	13.5	630.6	376.4	461.1	0.0136	0.0210	0.0293
(% of Total)	5%	3%	3%	0%	0%	0%			
9 COL/SNK/WIL	3.1	3.3	6.5	1439.3	1331.5	1299.8	0.0022	0.0025	0.0050
(% of Total)	2%	1%	2%	1%	1%	1%			
TOTAL	187.8	248.8	388.0	180,904.0	196,581.9	243,612.0	0.0010	0.0013	0.0016

SOURCES: O & M Costs - User Charge Data Base
Ton Miles - U. S. Army Corps of Engineers, WCSC, Waterborne Commerce of the U. S.

o Inflation factor from 1977-1988 according to "Implicit Price Deflator" based on overall GNP (OMB Series) is about 56%. 1982-1988 is about 82%

NOTE: GIWW and AIWW data are for 1989 since their 1990 ton-mile data were unavailable.

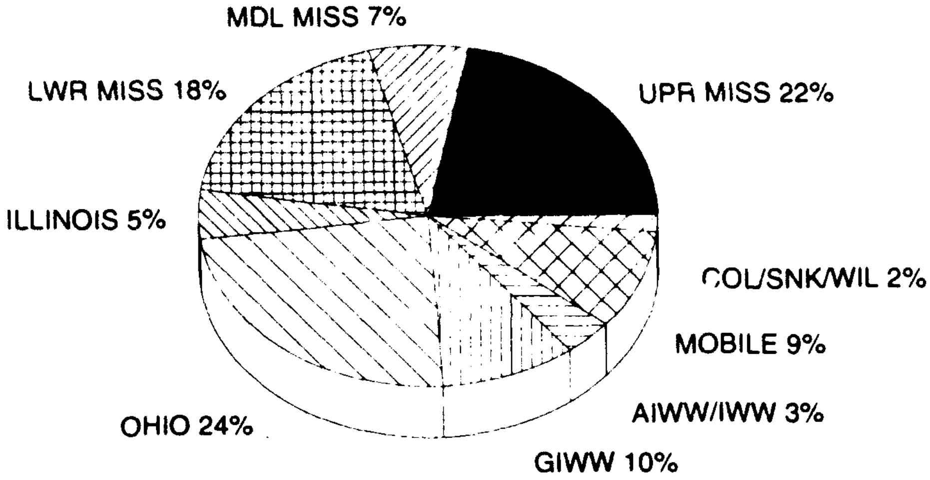


FIGURE 38: O&M COSTS FOR INLAND WATERWAYS SUBJECT TO FUEL TAX, 1990

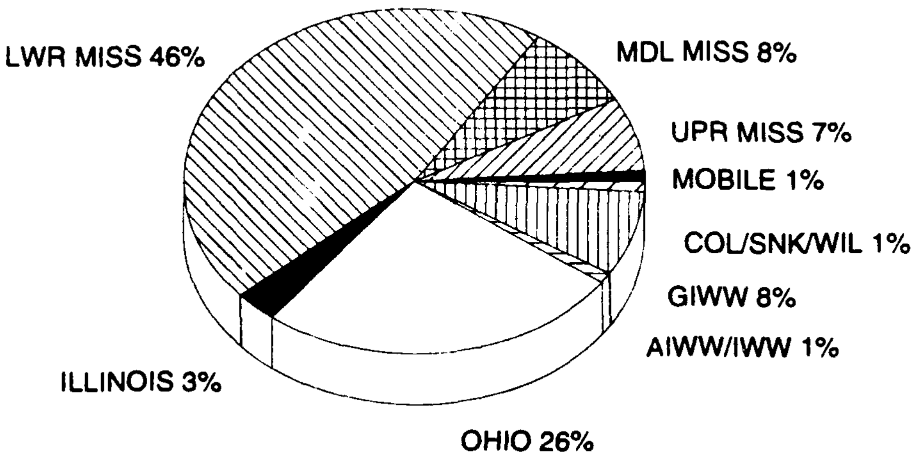


FIGURE 39: TON MILES FOR THE INLAND WATERWAYS SUBJECT TO FUEL TAX, 1990

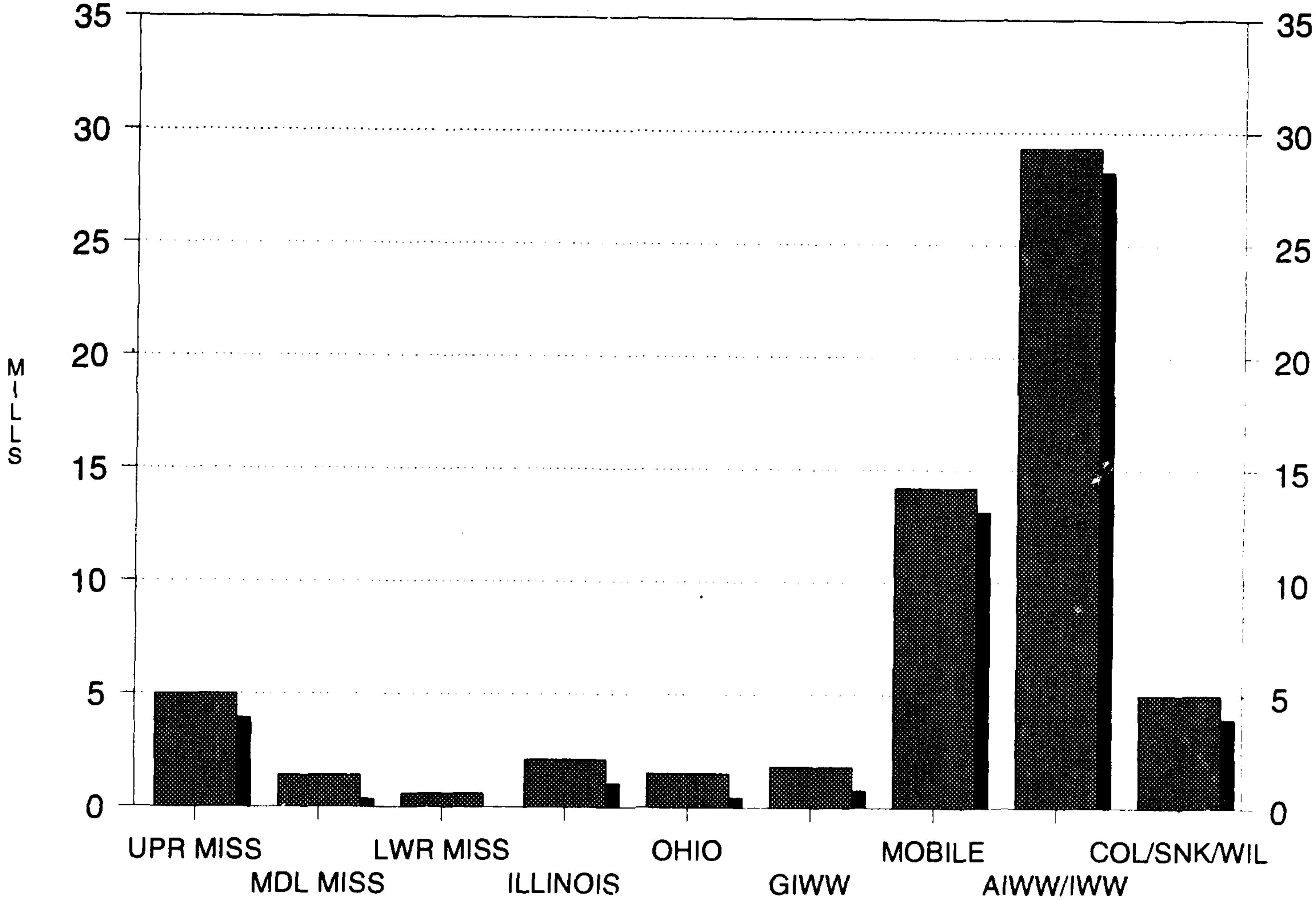


FIGURE 40: O&M COSTS PER TON MILE FOR WATERWAYS SUBJECT TO FUEL TAX, 1990

6.3 MAJOR REHABILITATION

Twenty-seven lock and dam structures have undergone major rehabilitation in the past ten years or are currently being rehabilitated (Table 26). Nearly $400 million has already been spent over the period FY 1978 to FY 1990 on these projects. Approximately $40 million will be required to complete the six projects currently under rehabilitation. The FY 1992 program includes $4.7 million to continue these projects. The President's Budget for FY 1993 requests funds to start three new major rehabilitation projects with a total cost of of approximately $75 million. These include about $20 million apiece for Locks and Dams 13 and 15 on the Mississippi River, and $33 million for four locks on the Illinois Waterway (Brandon Road, Dresden Island, Marseilles, and Lockport). The new starts would obtain half of their funds from the Inland Waterways Trust Fund.

The greatest number of recent major rehabilitation projects are in the waterway segments that contain aged structures and are heavily used. The Upper Mississippi River, on which a majority of the projects are 50 or more years old, accounts for about 45% of the projects (12 of 27) and one-third of the costs. The work has involved rehabilitation of the locks, lock gates, and lock machinery and equipment; of the dams' movable gates and emergency bulkheads; and scour protection downstream of the dams. The Illinois Waterway has had seven structures rehabilitated or about 27 percent of the projects and funds. Work there has involved rehabilitation of the locks and replacement of their gates and electrical machinery, rehabilitation of dams and their gates and maintenance of dam bulkheads, and rehabilitation of channel walls and resurfacing of lock guidewalls. The Ohio River system had six projects (five on the Ohio River, and one on the Monongahela River) accounting for about 23 percent of projects and funds. Some of the Ohio system work involved restoration of lock walls, installing new lock gates, replacement of mechanical and electrical equipment associated with operation of the dam and locks, structural repairs to and replacement of several dam components, and correction of undercutting problems around the base of dams. The Black Warrior and Columbia Rivers each have had one major rehabilitation project completed recently.

Budgetary guidance redefining major rehabilitation may reduce the future number and total program cost of lock and dam projects and cause an equivalent increase in major maintenance work. Major rehabilitation involves structural modification to significantly improve or extend the operational capabilities. The work would require two or more years to complete and the cost would be 20 percent or more of that for a replacement. The improvement would restore or enhance reliability and achieve a cost effective reduction in annual O&M expenditures. While new lock structures would not be included, other low cost capital and operational improvements may be considered.

A significant R&D program called Repair, Evaluation, Maintenance, and Rehabilitation is underway. Its primary objectives are (1) improving the technology and reducing costs of maintenance and repair and (2) developing a more systematic basis for programming and managing the Corps Civil Works repair and maintenance outlays.

6.4 CONSTRUCTION

Ten lock and dam projects on the fuel-taxed waterways have been scheduled for construction following authorization by the Water Resources Development Acts of 1986, 1988, and 1990. These projects include one or two additional replacement locks at Price on the Upper Mississippi River, Gallipolis, Olmsted, and McAlpine on the Ohio River, Grays Landing and Point Marion on the Monongahela River, Winfield on the Kanawha River, Oliver on the Black Warrior River, Bonneville on the Columbia River, and Inner Harbor on the GIWW. New

TABLE 26. MAJOR REHABILITATION PROJECTS COMPLETED, UNDER CONSTRUCTION, AND PROPOSED AS OF OCTOBER 1992

SEGMENT/WATERWAY PROJECT	START DATE	COMPLETE DATE	COST ($ mil.)
UPPER MISSISSIPPI RIVER			215.3
L&D 1	1978	1982	44.6
L&D 3,5A-9 (6 sites)(1)	1987	1999	49.9
L&D 14 (AUX)	1978	1982	7.8
L&D 19 (AUX)	1977	1980	5.2
L&D 20	1986	1991	38.4
L&D 21	1987	1990	13.8
L&D 22	1987	1990	15.1
L&D 13 (2)	1992	1996	21.3
L&D 15 (2)	1992	1996	19.2
ILLINOIS WATERWAY			165.7
LOCKPORT L	1983	1987	22.7
BRANDON ROAD L&D	1984	1988	23.8
DRESDEN ISL L&D	1978	1983	16.7
MARSEILLES D	1985	1988	15.0
STARVED ROCK L&D	1978	1985	13.3
PEORIA L&D	1986	1990	21.2
LA GRANGE L&D	1986	1990	20.3
FOUR LOCKS (2)	1992	1995	32.7

SEGMENT/WATERWAY PROJECT	START DATE	COMPLETE DATE	COST ($ mil.)
OHIO RIVER SYSTEM/OHIO RIVER			117.6
EMSWORTH L&D	1982	1986	37.9
DASHIELDS L&D	1986	1991	34.0
MONTGOMERY L&D	1985	1989	32.2
L&D 52	1980	1984	8.9
L&D 53	1980	1985	4.6
OHIO RIVER SYSTEM/MONONGAHELA R.			16.0
L&D 3	1978	1982	16.0
COLUMBIA-SNAKE WW/COLUMBIA RIVER			6.2
JOHN DAY L	1980	1983	6.2

SUMMARY OF MAJOR REHABILITATION PROJECTS

	NO.	COST THRU FY1991 ($ mil.)	COST BALANCE ($ mil.)	TOTAL COST ($ mil.)
COMPLETED THRU FY1991	20	397.7	0.0	397.7
UNDER CONSTRUCTION IN FY 1992(1)	6	11.6	38.3	49.9
NEW STARTS IN FY 1993(2)	6	0.0	73.2	73.2
TOTAL	26	409.3	111.5	520.8

(1) PROJECTS UNDER CONSTRUCTION IN FY-1992.
(2) PROJECTS PROGRAMMED TO START IN FY-1993.

dams are also part of three projects - Olmsted, Grays Landing, and Oliver. These projects are about 34 percent complete and all, except Olmsted, McAlpine, and Inner Harbor, will be operational by 1995. These new projects will reduce traffic delays and lower the cost of waterway transportation far in excess of their estimated costs of $3.4 billion.

There are ten other construction projects for inland navigation which have not been authorized to be funded through the Inland Waterways Trust Fund. Melvin Price Lock and Dam replaced the Locks and Dam 26 severe bottleneck above St. Louis in early 1990. In the Middle Mississippi River below St. Louis training works to maintain navigable depths are under construction. The MR&T project receives continuing outlays to complete bank protection and other works required to maintain navigation. A similar long term project involving bank stabilization and channel work is being carried out on the Atchafalaya River. The Arkansas Navigation System, whose 17 locks and dams were operational by 1970, is nearly complete, but studies indicate another lock and dam is needed at the mouth The Red River project with five locks and dams and improvement is under construction to Shreveport. Four new locks and dams on the Ouachita-Black River have been completed, but there is remaining channel improvement work. These and other projects have an estimated cost of $9.2 billion with a balance of $3.1 billion or 37 percent remaining after 1993.

6.4.1 Projects Using The Trust Fund (Table 27)

a. Mississippi River. A second lock, 600 feet long and 110 feet wide, was authorized in 1986 for the new Melvin Price Lock and Dam, which replaced Locks and Dam 26 above St. Louis in 1990. It is scheduled to be operational by May 1993 at an estimated cost of $212.6 million. It is 82 percent fiscally complete this year and would be 100 percent complete with the $37.8 million requested for FY 1993. Construction continues and is due to be completed in 1993 on the second lock.

b. Ohio River.

(1) Gallipolis Locks and Dam was authorized in 1986, and the $384 million project is scheduled to be completed in 1999 after the locks are operational in November 1992. It will have a new 1200 by 110 foot main chamber and a 600 by 110 foot auxiliary chamber constructed in a canal inland of the existing locks that will provide better lock approach conditions. The project will eliminate a major congestion problem, a severe navigation hazard, and increasingly difficult operation and maintenance problems due to old age. It is 67 percent fiscally complete this year and would be 74 percent complete with the $25 million requested for FY 1993. Work in 1992 and 1993 includes continuation of locks and canal construction, and initiation of dam rehabilitation, old lock deactivation, and construction of emergency mooring cells.

(2) Construction of Olmsted Locks and Dam to replace Locks and Dams 52 and 53 was authorized in 1988. Estimated cost for the project, consisting of twin chambers 1200 feet long and 110 feet wide and a dam that includes a 2,220 foot wide navigable pass section, is $1,110 million. Preconstruction engineering and design (PED), was completed in 1991 at a cost of $16.6 million. With the $60 million requested for FY 1993 to continue engineering and design and to initiate access road, wildlife facility, and lock cofferdam and slide repair construction, the project would be 7 percent fiscally complete. The lock is scheduled to be operational in 1999 and the entire project completed in 2006. Temporary 1200 by 110 foot locks were completed at Locks and Dams 52 and 53 in 1969 and 1980 respectively to permit transit of 15 barge tows with one lockage. Both dams are designed with a navigation pass which, during periods of sufficient flow can be used to provide navigation

TABLE 27. AUTHORIZED CONSTRUCTION PROJECTS IN THE FY1992 BUDGET THAT ARE FUNDED BY THE INLAND WATERWAYS TRUST FUND

(MILLIONS OF DOLLARS AS OF OCTOBER 1991)

SEGMENT/PROJECT	START OPERATION YEAR	PERCENT FISCALLY COMPLETE	PROJECT COST	ALLOCATED THRU FY92	REQUESTED FOR FY93	BALANCE AFTER FY93	REMARKS
UPPER MISSISSIPPI RIVER							
Miss. R., Price L&D,2nd L.	1986/1993	82	213	175	38	0	Repl. L&D 26
OHIO RIVER SYSTEM							
Ohio R., Gallipolis Ls.&D	1985/1992	67	384	257	25	102	Repl. locks
Ohio R., Olmsted Ls.&D	1991/1999	2	1,110	26	60	1,024	Repl. L&D 52&53
Monongahela R.,Grays L. L&D	1987/1993	64	174	110	30	32	Repl. L&D 7
Monongahela R.,Pt. Marion L&D	1987/1993	69	99	68	26	5	Repl. L 8
Kanawha R., Winfield Ls.&D	1987/1997	21	236	49	38	149	Added lock
GULF INTRACOASTAL WATERWAY							
Gulf Outlet, Inner Harbor L.	----/----	14	686	96	1	590	Repl. lock
MOBILE RIVER & TRIBUTARIES							
Black Warrior R., Oliver L&D	1987/1991	98	120	118	2	0	Repl. lock
COLUMBIA-SNAKE WATERWAY							
Columbia R., Bonneville L&D	1985/1993	90	331	299	27	6	Repl. lock
TOTAL		34	3,353	1,198	247	1,908	

SOURCE: USACE FY 1993 Civil Works Justification Data Congressional Submission

over the dam (60 percent of the time at L&D 52, and 90 percent of the time at L&D 53). In 1990 traffic through Locks and Dam 52 reached nearly 100 million tons after growing 37 percent during the previous decade.

c. Monongahela River.

(1) Lock and Dam 7 at Grays Landing, about 85 miles above the river mouth, will have its dam and old, 360 by 56 foot lock replaced with a 720 foot long and 84 foot wide chamber compatible with other new locks on the river. The estimated cost is $174 million. The lock is scheduled to be operational in March 1993 and the entire project complete in 1995. It is 64 percent fiscally complete this year and would be 81 percent complete with the $30 million requested for FY 1993. Work in 1992 and 1993 includes completion of land acquisition, continuation of relocations, buildings, grounds, and utilities, lock construction, and engineering and design, and initiation of dam construction.

(2) Lock No. 8 at Point Marion will also have its 360 by 56 foot chamber at mile 91 replaced by a 720 by 84 foot chamber. The estimated cost is $99.1 million. The lock is 69 percent fiscally complete this year and would be 95 percent complete with the $26 million requested for FY 1993. It is scheduled to be operational in the summer of 1993 and complete by September 1994. Work in 1992 and 1993 continuation of lock construction, buildings, grounds, utilities, and engineering and design and initiation of fixed weir construction.

d. Kanawha River. Winfield Locks and Dam, the busiest project in the inland navigation system in terms of lockages, is under construction to provide an 800 foot long and 110 foot wide lock landward of the 54 year old, twin 360 by 56 foot chambers. In 1990 the average delay per tow was 5.4 hours and the typical tow required four lockages. The scheduled operational date for the $236 million project is 1997. It is 21 percent fiscally complete this year and would be 37 percent complete with the $38 million requested for FY 1993. Work in 1992 and 1993 includes continuation of land acquisition, and engineering and design, continuation and completion of cultural resources reservation, and Phase I construction, and initiation of Phase II construction.

e. Gulf Intracoastal Waterway. The Inner Harbor Navigation Canal (IHNC) Lock, part of the Mississippi River - Gulf Outlet project, was authorized in 1956 for construction of a replacement lock at that site or at the Violet site in St. Bernard Parish with dimensions at the discretionary authority of the Chief of Engineers. The lock portion of the MRGO project, with an estimated cost of $784 million, is 11 percent fiscally complete this year and with the $2 million requested for FY 1993. An updated reanalysis study began in 1986 and is scheduled to yield a final evaluation report in 1995. Lock sizes evaluated have varied from a small shallow draft lock (640 feet long, 75 feet wide, and 21 feet deep) to a large deep draft lock (1200 feet long, 150 feet wide, and 50 feet deep). The evaluation study has used an open planning process involving various segments of the public and government agencies. Louisiana and the Port of New Orleans want a deep draft lock, but would have to pay 25 percent of the costs allocated to deep drafts up to 45 feet. The Inland Waterways Trust Fund would pay for 50 percent of the costs allocated to shallow draft navigation. Until the study is completed, the cost estimates for construction of the lock and user fund and non-federal shares are tentative. If economically justified and if a positive recommendation is made, then construction could begin in the late 1990s and take five to ten years depending on size and location. Completion of the shiplock is indefinite pending a decision to initiate construction.

f. Black Warrior River. William Bacon Oliver Lock and Dam began operations in July 1991 and the entire project is scheduled for completion in December 1992. A single 600 by 110 foot chamber and dam replaced the 460 by 95 foot lock and its dam. The $120 million project eliminates the need for multiple locking for the standard six barge tows using the system, reduces lockage time, and increases the traffic capacity. It is 98 percent fiscally complete this year and would be 100 percent complete with the $2.3 million requested for FY 1993. Work in 1992 includes completion of lock and dam construction.

g. Columbia River. The 675 foot long and 86 foot wide single chamber Bonneville Navigation Lock will operationally replace the 51 year old, 500 by 76 foot lock that has caused increasing delays (up to 8 hours) and congestion. The problem occurs because only two barges, out of an optimum tow configuration of five barges on the river system, can be locked through at one time. The $331 million project is scheduled to be operational by March 1993 and completed in September 1994. It is 90 percent fiscally complete this year and would be 98 percent complete with the $26.5 million requested for FY 1993. Work in 1992 and 1993 includes continuation and completion of lock construction, channels and canals, roads and bridges, and buildings, grounds, and utilities.

6.4.2 Projects Not Using Trust Fund (Table 28)

a. Mississippi River.

(1) Locks and Dam 26 was replaced in 1990 by a new dam and a lock 1200 feet long and 110 feet wide two miles downstream named Melvin Price Lock and Dam. The $737.4 million project is 95 percent fiscally complete this year and would be 97 percent complete with the $9.7 million requested for FY 1993. Significant work in 1992 and 1993 on the dam and main lock include continuation and completion of the dam third stage and esplanade fill and continuation of lands and damages and engineering and design.

(2) The Upper Mississippi River System Environmental Management Program includes long term resources monitoring with computerized inventory and analysis, habitat rehabilitation and enhancement projects, recreation improvements and studies, and traffic monitoring in the states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. Thus, this project also applies to the Middle Mississippi River. The $258.7 million project is scheduled for completion in 2002, except for the recreation component, which is unscheduled due to a low federal priority. The project is 24 percent fiscally complete this year and would be 31 percent complete with funds requested for FY 1993.

(3) The project on the Mississippi River between the Ohio and Missouri Rivers (Regulating Works) involves construction of improvements, such as channel realignments, dikes, and revetments, to reduce bank erosion and to improve the nine-foot channel for dependable year-round navigation. Construction began in 1910 and is scheduled to be complete in 2000 at an estimated total cost of $215 million. The project is 74 percent fiscally complete and would be 77 percent complete with the $5.8 million requested for FY 1993.

(4) The comprehensive project for Flood Control, Mississippi River and Tributaries (MR&T), provides flood damage reduction and improvement of the Mississippi River for navigation from Cairo, Illinois, to Baton Rouge, Louisiana. The Mississippi River channel improvement project includes dikes, revetments, dredging, and foreshore protection. Only nine feet of the 12 foot deep channel authorized in 1944 has been constructed. The $3,621.8 million project is scheduled to be completed in 2010. The project is 58 percent fiscally complete this year and would be 60 percent complete with the

TABLE 28. AUTHORIZED CONSTRUCTION PROJECTS IN THE FY1992 BUDGET THAT ARE NOT FUNDED BY INLAND WATERWAYS TRUST FUND

(MILLIONS OF DOLLARS AS OF OCTOBER 1991)

SEGMENT/PROJECT	START/ OPERATION YEAR	PERCENT FISCALLY COMPLETE	PROJECT COST	ALLOCATED THRU FY92	REQUESTED FOR FY93	BALANCE AFTER FY93	REMARKS
UPPER MISSISSIPPI RIVER							
Miss. R., Price L&D-1st Lock	1979/1990	95	737	698	10	0	Replaced L&D 26
Miss. R., Sys Envr. Mgt Prog.[1]	1986/1997	24	259	61	19	175	Habitat rehab.
MIDDLE MISSISSIPPI RIVER							
Miss. R., Regulating Works	1910/2000	74	215	159	6	50	Dikes, revetments
LOWER MISSISSIPPI RIVER							
Miss. R. Channel Improvement	1928/2010	58	3,622	2,090	93	1,437	Dikes and revetments
Arkansas R. System[2]	1963/1970	91	646	584	12	48	Levee, pool & basin
Ouachita-Black Rivers	1964/1984	91	273	232	0	41	All 4 locks are open
Red R., Mouth to Shrevept, LA	1973/----	75	1,847	1,318	35	400	3 Locks open; 2 indef.
Atchafalaya R.	1928/2010	42	1,648	686	27	927	Dikes and revetments
GULF INTRACOASTAL WWY							
Mouth of Colorado R.	1978/1993	36	28	>1	3	2	Chans. & [illegible]
MOBILE RIVER AND TRIBUTARIES							
Tenn.-Tom. Wwy.	1989/1996	46	71	32	10	29	Wildlife Mitigation
ATLANTIC INTRACOASTAL WATERWAY							
Fed. Hwy. Br. Replace., NC	1973/1999	41	79	32	8	39	2 compl.; 3rd in 1994
TOTAL	N.A.	63	9,247	5,828	202	3,078	

SOURCE: USACE FY 1993 Civil Works Justification Data Congressional Submission

[1]Also applies to the Middle Mississippi River segment

[2]Operation year and project cost exclude Montgomery Point L&D

$93 million requested for FY 1993. However, it is 87 percent physically complete. Work in 1992 and 1993 will be used to extend existing revetments and assure continued effectiveness of completed work at 40 locations and to construct dikes at 26 locations.

b. Arkansas River Navigation System. The entire project is scheduled to be complete in 2000 at a cost of $646.4 million. It is 91 percent fiscally complete this year and would be 93 percent complete with the $12.7 million requested for FY 1993. Work scheduled in 1992 and 1993 includes completion of the entrance channel levee and continuation of land acquisition and enlargement of the Wilbur D. Mills Dam (No. 2) stilling basin. In addition, a feasibility study of an additional lock and dam at Montgomery Point to solve low water problems in the entrance channel was completed in 1990. PED, costing $12 million and including an economic justification study, has begun this year and it is scheduled for completion in 1995. The estimated construction cost is $195 million, but it is not included in the project cost estimate. Overall project completion does not include the additional lock and dam. The Administration favors use of the Trust Fund for its construction.

c. Ouachita and Black Rivers. Construction of the nine foot deep, 100 foot wide channel with four 600 by 84 foot locks began in 1963. The $247.7 million, 382 mile long waterway project is 92 percent complete, but completion is now indefinite. No funds are allocated for FY 1992 nor are any requested for FY 1993. Louisiana has not provided rights of way to straighten the river south of the Arkansas state line. Planned construction could increase tow sizes to four barges to Crosset, AR, and to two barges to Camden, AR.

d. Red River. Construction on the $1,846.8 million project from the Mississippi River to Shreveport, resulted in the December 1991 opening of Lock and Dam No. 3, thereby extending limited navigation to mile 207, about 15 miles below Coushatta. Nine foot navigation is being maintained to Alexandria, LA in pool 2, approximately mile 104, and an interim pool at elevation 85.5 feet is being maintained above Lock and Dam No. 3. The entire 236 mile long waterway project with five 685 by 84 foot locks is 75 percent fiscally complete this year and would be 77 percent complete with the $35 million requested for FY 1993. Work scheduled for 1992 and 1993 includes continuation and completion of construction on two railroad bridges in Pool 2 and initiation and completion of construction on caps for six channel dikes. Completion of Locks, Dams, and Pools 4 and 5 is indefinite pending a decision to schedule remaining construction. The Administration opposes providing navigation to Shreveport.

e. Atchafalaya River. The Atchafalaya Basin project includes channels, locks, and bank stabilization that benefit navigation and other purposes. The $1,648 million project, part of the overall MR&T project, is scheduled for completion in 2010. It is 42 percent fiscally complete this year and would be 43 percent complete with the $27 million requested for FY 1993. However, it is 86 percent physically complete. Work scheduled in 1992 and 1993 includes raising the most deficient sections of levee and flood walls, providing necessary bank stabilization, realigning the channel, providing channel training works above Morgan City, and modifying pumping stations.

f. The GIWW, Mouth of the Colorado River, TX, project costing $35.6 million is scheduled for completion in June 1994. It is 92 percent fiscally complete and would be 95 percent complete with the $300 thousand requested for FY 1993. The 6.5 mile long, 12 by 100 foot navigation channel to Matagorda on the GIWW will benefit commercial fishing boats and oil field service vessels operating in the area and provide reliable access to the harbor of refuge on the Colorado River above Matagorda. Work in 1992 and 1993 includes completion of dredging of the connection channel to the GIWW. Although a part of the fuel taxed GIWW, the project is not drawing construction money from the Inland Waterways Trust Fund.

g. Tennessee-Tombigbee Waterway. Mitigation of wildlife losses resulting from construction, operation, and maintenance of the waterway project is being carried out through acquisition of 88,000 acres of separable lands and management of 92,600 acres of existing project lands for mitigation purposes. The $71.1 million project is 46 percent fiscally complete this year and would be 60 percent complete with the $10 million requested for FY 1993. The entire project is scheduled for completion in 1996.

h. AIWW, Replacement of Federal Highway Bridges in North Carolina at a cost of $79 million is 41 percent fiscally complete this year and would be 51 percent complete with the $8 million requested for FY 1993. Two of the five obsolete swing span bridges were opened to traffic in 1981 and 1986, and the entire project is scheduled for completion in 1999.

6.5 STUDIES

There are twelve studies underway or recently completed of projects identified in the regional needs assessments. These involve 25 potential lock and dam and three potential channel improvements. These studies include seven in the feasibility phase, and four in preconstruction, engineering and design (PED). These studies, being completed between 1990 and 1995, are likely to identify projects that will be available for construction starting in 1994.

The central Midwest, including the Upper Mississippi River and the Illinois Waterway, contains the potential for a large number of construction projects after the turn of the century, some possibly involving low cost improvements. Reconnaissance studies of those two rivers focused upon 24 locks and dams on the Upper Mississippi River and three locks and dams on the Illinois Waterway that were identified as probable improvements in the 1989 regional investment assessment.

The Ohio River system, the subject of eight studies of fourteen locks and dams and one channel project, holds the prospect of more projects being available for construction in the late 1990s. Five are feasibility studies, and three have advanced to PED. Of the projects identified in the regional assessment five are being studied on the Tennessee River and five on the Ohio River plus three on the Monongahela River and one on the Kanawha River.

Elsewhere there are a smaller number of studies and projects. The nine channel related improvements and one potential additional lock and dam on the Arkansas Navigation System are being or will be studied as part of that ongoing construction project (See 6.4.2b.). On the GIWW there are studies of two channel problems in Texas and a study of four locks on the main waterway and two locks on the Morgan City-Port Allen Route in Louisiana. There are no studies of three locks and dams on the Black Warrior-Tombigbee Rivers nor a set of gates in Texas.

There are 27 studies of projects not in the regional investment assessment and mostly not on fuel taxed waterways. Their potential improvements range from ones of local interest and low cost to those that would significantly expand the waterway system. The seven PED studies on the Red, Trinity, and Coosa Rivers and GIWW have the greatest potential for additional cost and waterway miles. Eight multiple purpose studies on the Arkansas, Green, Pearl, and Mermentau Rivers are not likely to recommend many improvements for inland navigation. Thirteen single purpose navigation studies on eleven waterways concern a variety of channel and lock and dam conditions face poor prospects for project construction.

6.5.1 Studies of Projects In Needs Assessment (Table 29)

a. Mississippi River and Illinois Waterway. The $17.2 million Upper Mississippi River and Illinois Waterway Navigation System study began in 1990 with reconnaissance studies on each waterway. A preliminary system plan was formulated and the initial project management plan (IPMP) is being refined. The study will begin the feasibility phase in FY 1993. The schedule for completion of the feasibility study depends upon adoption of the IPMP. The system study is being jointly conducted by the Rock Island and St. Paul Districts in the North Central Division and the St. Louis District in the Lower Mississippi Valley Division. The Study addresses the need for navigation capacity expansion along the Mississippi River, including 27 locks and dams, between Minneapolis-St. Paul and Price Locks and Dam and along the Illinois Waterway, including eight locks and dams, between Chicago and the Great Lakes and the Mississippi River above Price Locks and Dam. A systems approach has been adopted to examine existing engineering, economic, environmental, and social parameters and to determine system investment needs, including the costs of mitigating enviromental impacts.

The systems' principal problems are, (1) delays to commercial traffic at locks upstream of Price L&D due to limited lockage capacity and increasing traffic and (2) system congestion resulting in competition and conflict between recreational and commercial users. The 600 foot locks on both waterways routinely handle 1200 foot tows in costly and time consuming lock operations. Consequently eight locks on the Mississippi River and four locks on the Illinois Waterway are included among the twenty locks on the inland waterways with the greatest levels of delay and processing times. The reconnaissance studies recommended further study of adding 1200 foot locks at Locks and Dams 20, 21, 22, 24, and 25 on the Mississippi River and LaGrange and Peoria Locks and Dams and widening of Marseilles Canal on the Illinois Waterway.

b. Ohio River

(1) The feasibility study of McAlpine Locks and Dam in Louisville on the Lower Ohio River was completed in January 1990. It recommended replacement of the 600 by 110 foot auxiliary chamber and the inactive 360 by 56 foot third chamber with a 1200 by 110 foot lock at a fully funded cost now estimated at $316 million. Problems at McAlpine L&D include increasing congestion, operation and navigation complexities associated with a canal and several bridges, and an inefficient and obsolete 600 by 110 foot auxiliary chamber that essentially reduces the McAlpine facility to a single chamber project. These problems are expected to result in significant delays by the year 2000. PED costing $8.3 million began in 1990, would be 52 percent complete in 1993, and is scheduled for completion in 1995. This year foundation explorations and hydraulic studies continue and value engineering and economic benefit updates are being initiated. Next year design memoranda will be prepared and plans and specifications for the first construction contract will be started. Lock construction authorized by the 1990 Water Resources Development Act could begin in 1996 and be completed six years later in 2001.

(2) Emsworth, Dashields and Montgomery Locks and Dams were the subject of the $5.2 Upper Ohio River Navigation interim study. It was completed in September 1991. These structures, built between 1921 and 1936, are the last on the Ohio River with small 600 feet long main lock chambers. They are unable to lock the typical 15 barge Ohio River tow in a single lockage. Preliminary studies indicated that the most favorable plan is to rehabilitate or replace the dams and replace the locks with 1200 by 110 foot and 600 by 100 foot chambers at a cost of $640 to $840 million.

TABLE [illegible]. STUDIES OF PROJECTS IN NEEDS ASSESSMENT

(MILLIONS OF DOLLARS AS OF OCTOBER 1991)

WATERWAY/PROJECT	START/ COMPLETE YEAR	PERCENT FISCALLY COMPLETE	PROJECT COST EST.	YEAR AVAIL. FOR CONSTRUCTION	PROBABLE IMPROVEMENT
MISSISSIPPI RIVER					
L.&D. 20	1990-Unk	31	Unk	--	Add a 1200' x 110' L.
L.&D. 21	1990-Unk	31	Unk	--	Add a 1200' x 110' L.
L.&D. 22	1990-Unk	31	Unk	--	Add a 1200' x 110' L.
L.&D. 24	1990-Unk	31	Unk	--	Add a 1200' x 110' L.
L.&D. 25	1990-Unk	31	Unk	--	Add a 1200' x 110' L.
ARKANSAS RIVER					
Montgomery Pt. L&D	1992/1995	11	195	1995	New 600' x 110' [illegible] At Mouth
ILLINOIS WATERWAY					
LaGrange L.&D.	1990-Unk	31	Unk	--	Add a 1200' x 110' L.
Peoria L.&D.	1990-Unk	31	Unk	--	Add a 1200' x 110' L.
Marseilles L.&D.	1990-Unk	31	Unk	--	Widen canal
GULF INTRACOASTAL WWY.					
Sargent Beach	1988/1994	16	91	1996	PED. Create buffer between Gulf & GIWW
Aransas Nat. Wild. Ref.	1988/1994	62	Unk	1996	Protect 30 mi. of chan. banks
Algiers L.	1990/1995	23	Unk	--	
Port Allen L.	1990/1995	23	Unk	--	
Bayou Sorrel L.	1990/1995	23	Unk	--	
Calcasieu L.	1990/1995	23	Unk	--	
OHIO RIVER					
McAlpine Ls.&D. (1)	1990/1995	29	219	1997	PED. Replace aux. Lock with a 1200' x 110' Lock
Emsworth Ls.&D.	1981/1991	100	280	--	None (1200'& 600' Ls.)
Dashields Ls.&D.	1981/1991	100	280	--	None (1200'& 600' Ls.)
Montgomery Ls.&D.	1981/1991	100	280	--	None (1200'& 600' Ls.)
Uniontown Ls.&D.	1990/1996	30	Unk	1999	Repl. aux. w/ 1200' x 110' L.
MONONGAHELA RIVER					
Ls.&D 2	1991/1996	5	895	1996	PED. Replace dam
Ls.&D 3	1991/1996	5	Unk	1996	PED. Remove L.&D.
Ls.&D 4	1991/1996	5	Unk	1996	PED. Repl. w/720' x 84' Ls.
KANAWHA RIVER					
Marmet Ls.&D.	1982/1993	79	200-250	1997	Repl. 1 L. w/ an 800' x 110' L.
CUMBERLAND RIVER	1975/1992	100	Unk	--	None (Widen channel)
TENNESSEE RIVER					
Kentucky L.&D.	1992/1998	7	448	1999	PED. Add a 1200' x 110' L.
Chickamauga L.&D.	1975/1994	85	196	1998	Add a 600' x 110' L.
Watts Bar L.&D.	1975/1994	85	Unk	1999	None (600' x 110' L.)
Wilson Ls.&D.	1975/1994	80	565	1999	Repl. aux. Ls. w/ 1200' x 110'L.
Nickajack L.&D.	1975/1994	80	90	1999	Complete 800' x 110' lock

NOTES: (1) Authorized by the 1990 Water Resources Development Act.

SOURCE: USACE FY 1993 Civil Works Justification Data Congressional Submission and Study & Project Fact Sheets

(3) A reconnaissance-stage draft report for the Uniontown L&D was completed in March 1991. Following a Reconnaissance Review Conference in September 1991, it was decided that the study should be broadened in scope to address and prioritize navigation needs throughout the entire Ohio River Main Stem. A revised "plan of study" document (Initial Project Management Plan or IPMP) is being prepared to identify the exact scope of the expanded study effort and its schedule. The broader study will focus primarily on the need for improvements or additional lock capacity at Uniontown, Newburgh, and/or Cannelton Locks. Since these projects all have one 1200-foot long lock and a 600-foot long auxiliary chamber, delays will increase and waterway operating costs rise as traffic increases. Currently, lock delays at these three locks average between 30-50 minutes per tow, but can grow to as much as 50 hours or more when one of the main chambers is closed for maintenance. The broader study may also include a Reconnaissance-level review of capacity, maintenance, major rehabilitation, and other needs along the entire river. Structural measures considered will focus particularly on low-capital cost designs. Estimated budget levels for FY93 study efforts are about $1.0 million.

c. Monongahela River. The feasibility study of Locks and Dams 2, 3, and 4 to determine what navigation structure improvements are needed for the undersized and deteriorating facilities was completed in September 1991. The condition and size of these locks are a major impediment to low cost water transportation on the Monongahela River and the upper Ohio River. The recommended plan calls for replacement of Dam No. 2, removal of Locks and Dam No. 3, and replacement of No. 4's locks with twin 84 by 720 foot locks at a cost of $895 million. PED costing $14.3 million that began this year with model studies and initial work on design memoranda is scheduled to be completed in 1996.

d. Kanawha River. The $4.4 million interim feasibility study of Marmet Locks and Dam is 84 percent fiscally complete this year and is scheduled for completion in September 1993. The 55 year old structure is the second busiest lock in the Ohio River system due to its small twin 360 by 56 foot chambers, which can only process one modern 195 by 35 foot barge at a time. Preliminary assessment indicates that replacing one of the chambers with a larger lock is feasible at a cost of about $200 - $250 million. In 1992 hydraulic model studies on the best plan were completed and the draft report was initiated.

e. Cumberland River. The $10 million study of the Cumberland and Tennessee Rivers below Barkley Canal was completed in March 1992. Ten narrow tight bends on the lower Cumberland River discourage tows from using the Barkley Lock and Dam. The congested Kentucky Lock and Dam on the Lower Tennessee River and the Barkley Canal is the preferred connection with the Ohio River. Possible widening of critical bendways and modifying Barkley hydropower releases were not recommended.

f. Tennessee River.

(1) Kentucky Lock and Dam faces potential increased traffic stemming from: (1) increasing Cumberland River traffic using Barkley Canal and Kentucky Lock rather than the Lower Cumberland River, (2) increasing Tennessee River traffic, and (3) new traffic using the Tennessee-Tombigbee Waterway. Lock delays now average four to five hours and occasionally some are as much as 19 hours. The recommended improvement is an additional lock measuring 1200' by 110' at an estimated cost of $448.3 million. PED starts after final approval of the report, but no funds have been requested for FY 1993.

(2) Chickamauga, Watts Bar, and Fort Loudon Locks and Dams, with 50+ year old single chambers of 360 by 60 feet, are the focus of the upper Tennessee River study, which is now the responsibility of the Tennessee Valley Authority. Chickamauga and Watts Bar were identified in the Needs Assessment.

The $2.7 million study is 85 percent complete this year and is scheduled for completion in September 1993. These projects are not large enough to handle the modern Tennessee River tow of up to 15 barges, thus causing lockage times of eight hours that hamper the development of natural resources and industrial potential upstream of Chattanooga. The study indicates that an additional lock measuring 600 by 110 feet at Chickamauga, with an estimated cost of $196 million, will probably be the recommended improvement.

(3) The middle Tennessee River, with a 600 by 110 foot main or single chamber lock at Wilson, Wheeler, Guntersville, and Nickajack Locks and Dams, is included in the Cumberland-Tennessee Rivers study. Wilson and Nickajack were identified in the Needs Assessment. Analysis of these projects and any recommended improvements will be presented in the Cumberland-Tennessee Rivers main report, which is 64 percent complete this year and is scheduled for completion in September 1994.

g. Gulf Intracoastal Waterway

(1) The $1 million study of Sargent Beach, located about 170 miles north of Corpus Christi and 20 miles southwest of Freeport, was completed in 1991. It examined erosion of the 600 to 900 foot wide, seven mile long land barrier between the GIWW and the Gulf of Mexico. Historic erosion rates of 33 feet per year would breach the GIWW soon after the year 2000, thus closing the waterway and requiring its nearly 19 million tons of traffic to use an alternative mode of transportation. The PED costing $2.5 million started immediately after study completion and it is scheduled for completion in May 1994. Construction of eight miles of rock revetment costing an estimated $90.7 million could begin later in 1994. When authorized, the project would be eligible for funding from the Inland Waterways Trust Fund.

(2) The related $1.1 million Matagorda County Shore study is analyzing the coastal processes at Sargent Beach, the mouth of the Colorado River, and other shores in this reach. The reconnaissance study was completed in June 1991 and the feasibility study is scheduled for completion in June 1994.

(3) The $2.0 million study of the Aransas National Wildlife Refuge, located approximately thirty-five miles northeast of Corpus Christi, saw its reconnaissance phase completed in 1989. The feasibility study, 62 percent complete this year, is scheduled for completion in September 1994. The study is examining erosion caused by waterway traffic and natural wave action along a 31 mile stretch of the GIWW, of which 13 miles are in the refuge. The bank erosion of 1.5 to 3 feet per year damages the designated critical winter habitat of the rare and endangered whooping crane, as well as for many other birds and mammals.

(4) A $4.5 million study is being conducted of seven Intracoastal Waterway Locks in Louisiana. The seven GIWW locks in the state will be the subject of a comprehensive systems analysis in this interim study of the GIWW, Louisiana - Texas. They are structurally sound, but experience average delays due to restrictive dimensions of 2.7 to 4.6 hours at the four most congested locks. The study is 23 percent fiscally complete this year and would be 50 percent complete with funds requested for FY 1993. The reconnaissance study was started in 1991 and completed in August 1992, while the feasibility study is scheduled for completion in 1995.

h. Black Warrior and Tombigbee Rivers. A study to determine the advisability of modifying the existing project, particularly Coffeeville and Demopolis Locks and Dams and the related channel, was included in a final report completed in 1985. Additional studies concerning navigation efficiency of the existing waterway, navigation to Birmingham, lockage water shortage,

and environmental studies concerning the waterway south of Demopolis were also included in the report. No improvements in navigation were recommended.

6.5.2 Studies Of Projects Not In Needs Assessment (Table 30)

a. Arkansas River System. There are four basin multiple purpose studies that include navigation, but none are expected to recommend channel or lock and dam projects.

(1) The $2.6 million Central Arkansas study is primarily investigating flood problems in five counties, but also navigation. The reconnaissance study was completed in 1990 and the feasibility study is scheduled for completion in 1996.

(2) The Arkansas River and Tributaries, Great Bend to Tulsa, KS and OK, study was completed in 1991. Studies showed that costs for extending navigation upstream of Tulsa would exceed benefits.

(3) The $2.2 million Arkansas River Basin study, completed in 1990, considered navigation operation problems related to the magnitude and duration of flows above 75,000 cubic feet per second at James W. Trimble Lock and Dam. The report recommended levee repair by local sponsors, but no further Corps action.

(4) The Arkansas River and Tributaries, South Central and Southeast Areas of Oklahoma Comprehensive Study, completed in 1988, considered measures for extension of navigation into the Poteau and Deep Fork Rivers along with other water resource problems and needs, but recommended no Corps action.

b. The White River and tributaries navigation $1.2 million study is investigating the impact on navigation, water supply, and recreation of operating the White River reservoirs during low water periods in the summer and fall to ensure continuous downstream flows of sufficient depth to reduce navigation delays and transportation costs. The reconnaissance study was completed in 1989 and the feasibility study is scheduled for completion in September 1994.

c. Red River (Non Fuel Taxed Waterway above Shreveport).

(1) The authorized $656.8 million Red River Waterway, Shreveport to Daingerfield, TX, about 70 miles west of Shreveport, would include a nine foot deep and 200 foot wide channel, three dams (two existing), and three 600 by 84 foot locks. PED was begun in the mid 1970s, deferred, and then resumed in 1989. It is about 40 percent complete with receipt of $3.2 million Congress appropriated for FY 1992. The project is not currently budgeted for FY 1993.

(2) The authorized Red River Waterway, Shreveport to Index, AR (10 miles north of Texarkana), is a portion of a comprehensive project up to Denison Dam, TX. Authorized features are bank stabilization. Planning Engineering and Design investigations indicated that construction of the remaining features are not economically feasible at this time.

(3) The authorized Red River Waterway, Index to Denison Dam, has only 11 percent of its $5.3 million PED completed. Congress added funds for FY 1990 and 1991 to reevaluate the feasibility of flood damage reduction. It is not budgeted in FY 1991 due to its low priority, and has an indefinite completion date.

TABLE 30. STUDIES OF PROJECTS NOT IN NEEDS ASSESSMENT

(MILLIONS OF DOLLARS AS OF OCTOBER 1991)

WATERWAY/PROJECT	START/ COMPLETE YEAR	PERCENT FISCALLY COMPLETE	PROJECT COST EST.	YEAR AVAIL. FOR CONSTRUCTION	PROBABLE NAV. IMPROVEMENT
ARKANSAS RIVER SYSTEM					
Central Arkansas	1989/1992	--	--	--	None
Gt. Bend-Tulsa	Unk./1991	100	--	--	None
Arkansas R. Basin	Unk./1990	100	--	--	None
SC&SE Oklahoma	1984/1988	100	--	--	None
RED RIVER					
Shrvpt.-Dngrfld.(2)	1973/----	40	$657	Indef.	PED. Inact. (3 Ls. & 2 D.)
Shrvpt. -Index(2)	1976/----	88	Unk.	Indef.	PED. Inact. (Bank stab.)
Index-Den. Dam(2)	Unk./----	11	Unk.	Indef.	PED. Inact. (Bank stab.)
KANAWHA RIVER					
London Ls.&D.	1986/1994	53	--	--	Major maintenance
BIG SANDY RIVER	Unk./1986	100	--	--	None (Channel extension)
GREEN-BARREN Rs.					
L.&D. 3	1961/1995	65	$52	--	None (360'x 75' L.)
L.&D. 4	1961/1995	65	$52	--	None (360'x 75' L.)
L.&D. 1(Barren)	1961/1995	65	$15	--	None (Rehab. L. & D.)
TENNESSEE RIVER					
Ft. Loudon L.&D.	1975/1993	85	--	--	None (600' x 110' L.)
Wheeler L.&D.	1975/1994	80	--	--	None
Guntersville L.&D.	1975/1994	80	--	--	None
LAKE ERIE-OHIO R.	1988/1990	100	Unk.	--	None (10 Ls. & Ds.)
PEARL RIVER					
Basin Multi Purpose	1963/1989	100	--	--	None
Lwr. Pearl Flow Distr.	1988/1992	100	Unk.	Unk.	Unknown
GULF INTRACOASTAL WATERWAY					
LA.-TX. Channel	1976/1992	100	--	--	None (Widen channels)
Channel to Victoria	1988/1992	100	$28	1992	PED. Enlarge to 12'x125'
MERMENTAU RIVER					
GIWW to Gulf	1989/1991	100	--	--	None (new channel)
Mer, Ver,&Calc Rs.	1984/1991	100	--	--	None
TRINITY RIVER					
Channel to Liberty(2)	Unk./----		$175	Indef.	PED. Inact. (L.&D.)
BRAZOS R. DIVER.CH.	1987/1991	100	Unk.	1995	Shorter channel to Gulf.
MATAGORDA SHIP CHANNEL					
Pt. Lavaca to Red Bluff	1989/1995	23	Unk.	1999	Enlarge to 12'x 125'
COOSA RIVER					
Montgomery to Gadsden(2)	1977/----	92	$1,359	Indef.	PED. Inact. (5 locks)
Gadsden to Rome(2)	Unk./----	0	(1)	Indef.	PED. Inact. (1 lock)
AIWW, NORFOLK-ST. JOHNS R.					
Dismal Swamp Canal	1986/1987	100	--	--	No change
SAVANNAH RIVER					
New Savannah Bluff L	1987/1988	100	--	--	Retain in caretaker status
Lower Savannah River	1986/1989	100	--	--	None. (Channel O&M)
Lwr. Sav. R. Impacts	1990/1995	53	--	--	Unknown
Sav. R. Wtr. Alloc.	1986/1993	64	--	--	Unknown
MIDDLE COLUMBIA R.	1977/1989	100		--	None (3 barge lifts & chan.)

NOTE: (1) Cost included in total of $1,359 for project.
(2) Authorized

SOURCE: USACE FY 1993 Civil Works Justification Data Congressional Submission and Study & Project Fact Sheets

(4) The Red River Basin Comprehensive Study, considering measures for development of navigation and other purposes, was divided into two studies, one on the upper river and one on the lower river. The $5.3 million study of the Red River basin within Louisiana and Arkansas from Shreveport to Index has not proceeded to the feasibility phase because the reconnaissance phase completed in 1990 was negative. The multiple purpose study of the Red River, Denison Dam - Lake Texoma, in Oklahoma and Texas was completed in 1990.

d. The Lake Erie-Ohio River Canal, OH and PA (Non Fuel Taxed Waterway), study was completed in 1990 for $314,000 It reexamined the project authorized in the 1940s that would use the Beaver, Mahoning, and Grand Rivers and ten locks and dams to provide a waterway between Fairport on Lake Erie in northeastern Ohio and Aliquippa-Rochester on the Ohio River in southwestern Pennsylvania via Youngstown and Warren, Ohio.

e. Big Sandy River. The Big Sandy River and Tug and Levisa Forks, WV and KY (Non Fuel Taxed Waterway), were investigated, but an unfavorable interim report was completed in 1986. It considered extension of navigation up the Big Sandy River beyond mile 8.5 through channel excavation or locks and dams.

f. Kanawha River,WV. The interim feasibility study on London Locks and Dam is underway and scheduled for completion in September 1994. Work on traffic forecasts, assessment of alternatives, engineering and design studies and economic and environmental analysis is to be completed in FY 1993. The chambers at London are the same size as Winfield and Marmet Locks downriver, but river traffic is only about 40 percent of that for Winfield. However, in 1990 lock traffic increased about 25 percent due to the demand for low sulfur coal and further increases in traffic could result in lock congestion at London early next century. Shippers support improvements at London. After this third interim report, the $9.2 million Kanawha River Navigation Study would be completed.

g. Green and Barren Rivers,KY. The Reconnaissance study was completed in 1990. The $3.08 million feasibility study began in 1991, and is 29.7% complete this year. Completion is scheduled in 1995. Local interests desire restoration and modernization of navigation on both rivers to Bowling Green on the Barren River to provide more competitive transportation and thereby improve opportunities for economic expansion. The study found replacement of Lock and Dam No. 3, a non-operational 154 year old structure with a 138 by 38-foot chamber, to be feasible with a new chamber of 360 by 75 feet, costing about $52 million. The feasibility study is considering No. 3 in more detail and re-examining benefits and costs of the Lock and Dam 3 replacement. No consideration is being given to improvements to Lock and Dam 4 on the Green or for Lock and Dam 1 on the Barren River in the feasibility study. No funds were requested for FY 1993 although funding is expected via Congressional aid. An economically justified project is expected to have strong competition for PED and development funding.

h. Tennessee River.

(1) Fort Loudon Lock and Dam, TN, with a 360 by 60 foot chamber, is included in the upper Tennessee River interim study (see 6.5.1f.(2)). The study is 37 percent complete this year and is scheduled for completion in September 1994. The estimated cost for an additional lock would be $250 million.

(2) Wheeler and Guntersville Locks and Dams, AL, both with 600 by 110 foot single chambers, are included in the Cumberland-Tennessee Rivers study (see 6.5.1f.(3)). The study is 64 percent complete this year and is scheduled for completion in September 1994. Studies thus far indicate no improvement will be recommended.

i. Pearl River, LA and MS.

(1) The basin multiple purpose study was completed in 1989. Navigation studies included a reanalysis of the existing West Pearl River navigation project which had been placed in a caretaker status in the early 1970's after a decline in traffic, investigations of extending navigation on the East Pearl River upstream to Picayune, Mississippi, and investigations of navigation improvements to Port Bienville, Mississippi. These studies were completed in 1987. Maintenance dredging necessary to reopen the West Pearl navigation project was found economically justified under current economic conditions. Maintenance dredging on the West Pearl River was resumed in December 1988. Studies found that extension of navigation to Picayune was economically infeasible. Studies indicated that navigation improvements to Port Bienville were economically justified; however, studies were terminated when the local share of the project cost exceeded the financial capability of the local sponsor and they withdrew as sponsor.

(2) The Lower Pearl River Basin Flow Distribution Study investigated navigation and other problems and needs related to low flows from the East Pearl River entering the West Pearl River. The reconnaissance phase was completed in 1989. Reconnaissance studies found no Federal interest in additional water resource development. Studies were terminated at the conclusion of the reconnaissance phase with the recommendation that no further studies be conducted at this time.

j. Gulf Intracoastal Waterway.

(1) The feasibility study of the Louisiana portion of the Louisiana - Texas section examined whether the existing project should be modified, particularly with regard to widening and deepening the channels. It was completed in 1991 with negative results, so it will not proceed to PED.

(2) The Channel to Victoria,TX, project, which involves enlargement of the channel from nine feet deep and 100 feet wide to the standard GIWW dimensions of twelve by 125 feet for 35 miles via the Guadalupe River, was authorized in 1988. PED costing $1.4 million was initiated in FY 1989 and is scheduled for completion in September 1992. The $28.3 million project would be 7 percent fiscally complete with the $1 million requested for FY 1993. It is being considered as a channel for a harbor of 20 foot depth or less for cost sharing purposes. Therefore, no money for the project will be drawn from the Inland Waterways Trust Fund.

k. Mermentau River, LA (Non Fuel Taxed Waterway).

(1). The Mermentau, Vermilion, and Calcasieu Rivers and Bayou Teche are the subject of a multiple purpose basin study that includes navigation. The $5.4 million study is scheduled for completion in 1996. Interim reports on navigation channels to the Gulf of Mexico via the Mermentau River and from New Iberia were completed in 1975 and 1981 respectively, and on the Lake Charles Ship Channel in 1987. The only active interim study, the Grand and White Lakes Water Management Study, includes navigation as a purpose. It was completed in December 1991.

(2). The $1 million study of the Mermentau River, GIWW to the Gulf, had its reconnaissance phase started and completed in 1990. The feasibility study started in 1991 has been terminated because a project is not economically feasible. The focus of the study was a direct route to the Gulf from Jennings, LA, saving up to 20 hours of travel time on a round trip. Two possible alternatives were a new land cut or maintenance of a channel through Grand Lake, which is now too shallow for commercial vessels.

l. The Trinity River, Channel to Liberty, TX, (Non Fuel Taxed Waterway). Authorized in 1965 as part of a multiple purpose project that included a navigation channel with locks and dams to Dallas and Fort Worth, the $1,003 million Trinity River project is now limited to a twelve foot deep and 200 foot wide multiple purpose channel costing $175.2 million. It would extend from the Houston Ship Channel eastward across Trinity Bay and northward along the shore and up the Trinity River through the 600 by 84 foot Wallisville Lock and Dam to Liberty (river mile 45). A court injunction halting work in 1973, when construction was 72 percent complete, was lifted in 1987. Completion of the preconstruction studies are indefinite due to the indefinite nature of project benefits. A 1986 economic reevaluation revealed the authorized 200 foot wide channel was not feasible, but two smaller alternatives (100 foot and 75 foot widths) were potentially economically feasible. The inactive studies to prepare a supplement to the Phase I General Design Memorandum and the Environmental Impact Statement are aimed at optimization of a scaled-down navigation channel.

m. Brazos River Diversion Channel, TX, (Non Fuel Taxed Waterway). A study of a shorter route between Freeport and the Gulf of Mexico for use by offshore crew and service vessels and commercial fishing boats began in FY 1988 and was completed in February 1991.

n. The $780,000 study of the Matagorda Ship Channel, Port Lavaca to Red Bluff, is 23 percent complete and is scheduled for completion in 1995 after completion of its reconnaissance phase in September 1991. It will consider modifying the 20 mile long channel above Port Lavaca from its six foot deep and 100 foot wide dimensions to twelve by 125 feet as found on the GIWW. The study and any construction will be cost shared with local government since the project is a channel for a harbor of 20 foot depth or less.

o. Coosa River, AL (Non Fuel Taxed Waterway).

(1) The Coosa River, Montgomery to Gadsden,AL, was initially authorized in 1945 to include installing 600 by 84 foot locks in five of the seven Alabama Power Company dams and constructing a 9 by 150 foot channel. PED began in 1978 and is now 92 percent complete. Construction could be initiated within a year after appropriations are received and completed in about ten years. An economic evaluation restudy, which considered use of barge lifts as well as locks, was completed in 1989 and found that costs exceeded benefits.

(2) Coosa River, Gadsden to Rome, AL and GA. Plans for the extension from Gadsden to Rome, Georgia, have been deferred until the extension to Gadsden is assured.

p. AIWW, Norfolk to St. Johns River, FL. A project review study of the Dismal Swamp Canal on the Dismal Swamp Canal route in Virginia was conducted in 1985 and 1986 to consider changes in operation or disposition of the project due to marginal usage. The study recommended continued operation of the canal by the Corps if there is local cooperation or to attempt to transfer responsibility to the Department of Interior's Fish and Wildlife Service if there isn't local cooperation. The study report has been reviewed in Washington and at the local level. Local cooperation involving construction of a visitor center has not been obtained.

q. AIWW, Jacksonville to Miami. A $922,000 study is being conducted of the Federal bascule bridge over the IWW about 11 miles south of Jacksonville Beach. The outdated Palm Valley bridge cannot handle current or future vehicular traffic demands. The reconnaissance study was completed in 1990 and the feasibility study is scheduled for completion in 1993 at full Federal expense. It would be 77 percent fiscally complete with funds requested for FY 1993.

r. Savannah River Below Augusta, GA and SC, (Non Fuel Taxed Waterway).

(1) A separate project review study in 1988 considered disposition of the project, particularly the New Savannah Bluff Lock and Dam, due to marginal usage. While the project is in caretaker status, the operation of the 360 by 56 foot lock and recreation area near Augusta is being performed under contract by the City of Augusta. The Corps still operates the gates and dams above Augusta to provide for regulated flows on the Savannah River for navigation and other purposes.

(2) Following completion in 1987 of a reconnaissance study of the Savannah River Basin, a study of navigational improvements on the lower 40 miles of the Savannah River below Augusta was initiated. The reconnaissance phase was completed in June 1988 and the feasibility phase was completed in September 1989. No local project sponsor was obtained.

(3) A new $650,000 Lower Savannah River Basin Study began in FY 1991 with the reconnaissance phase to be completed in August 1992. The feasibility study, scheduled for completion in 1995, would be 72 percent complete with funds requested for FY 1993. The study is considering impacts of the navigation project on wetlands, silting and shoaling of streams and channels, Savannah's water supply, as well as continued operation of the lock and dam.

(4) Reactivation of the Savannah River Basin study in FY 1992 will determine the need for reallocation of water storage from the Three Savannah River lakes for recreation and water supply. The $1.4 million study will also determine the need for a comprehensive plan for their operation, including a drought contingency plan. The reconnaissance phase was completed in June 1991 and the feasibility study is scheduled for completion in December 1993.

s. Columbia River, WA. The U.S. Army Corps of Engineers, The Bureau of Reclamation, and the Bonneville Power Administration have joined together to conduct the System Operation Review (SOR). It is a comprehensive evaluation of how the Columbia River is managed to serve the Northwest. The review is needed because major agreements that involve power generation of the Columbia River will begin to expire near the turn of the century. These agreements are the Pacific Northwest Coordination Agreement and the Canadian Entitlement Allocation Agreements. A number of other public issues such as water allocation needs for fish, recreation, irrigation, and navigation are different now than when the agreements now in use were established. The SOR is therefore a complex interagency study with important international considerations. Various operating plans under consideration as planning alternatives will have a variety of impacts on operation and maintenance of the inland navigation system.

In 1989, a separate Interim Report under the authority of the Columbia River and Tributaries addressed extension of the inland system. The study evaluated alternative plans that included barge lifts at three existing dams between Richland and Wenatchee, Washington, and dredging of a channel between the existing Columbia River navigation channel and Richland. The proposal was found to lack economic justification.

CHAPTER 7
STATUS OF THE INLAND WATERWAYS TRUST FUND

7.1 INTRODUCTION

The Inland Waterways Trust Fund was authorized by the Inland Waterways Revenue Act of 1978 (PL 95-502) and amended by the Water Resources Development Act of 1986 (PL 99-662). The stated purpose of the Fund is almost identical in both Acts, and is basically as follows:

Amounts in the Inland Waterways Trust Fund shall be available, as provided by appropriations Acts, for making construction and rehabilitation expenditures for navigation on the inland and coastal waterways of the United States described in section 206 of the 1978 Act as amended.

The 1986 Act modified the original authority in two respects. First, it omitted the limitation that "No amount may be appropriated out of the Fund unless the law authorizing the expenditure...explicitly provides that the appropriation is to be made out of the Trust Fund." Second, it specified that the share of costs to be paid from the Trust Fund would be one-half, for the eight projects authorized to use the Fund in the 1986 Act. The first modification enables appropriations committees as well as public works committees to authorize use of the Fund, and addresses the question that arose when the first authorized use was contained in the Supplemental Appropriations Act of 1985. The second modification made the determination of Trust Fund cost share authorization-specific, and set a precedent for a 50% share of construction costs.

The creation of the Inland Waterways Trust Fund is linked to the imposition of a waterway fuel tax in both the 1978 and 1986 Acts. In the 1978 Act, Section 292 specifies the amount of tax and certain exceptions, and Section 206 specifies the waterways where the tax applies. In the 1986 Act, Section 1404 amends the two sections in the earlier Act, to increase the amount of the fuel tax, and to add the Tennessee-Tombigbee Waterway to the waterways where the tax applies. Both Acts provide for an increase in the tax over time, and the resulting rates are as follows:

Fuel use after:	Tax in cents per gallon is:
September 30, 1980	4
September 30, 1981	6
September 30, 1983	8
September 30, 1985	10
January 1, 1990	11
January 1, 1991	13
January 1, 1992	15
January 1, 1993	17
January 1, 1994	19
January 1, 1995	20

The 27 waterways or waterway segments where the tax applies are described in the two Acts, with the limits defined by river mile points in most cases. Based on the high specificity of those descriptions, the intent of Congress has been interpreted to mean that the fuel tax applies only on waterway mainstems, and unspecified tributaries and side channels are exempt. Conversely, although both Acts specify that expenditures from the Fund are to be for the waterways described, the 1986 Act authorized use of the Fund for a new Bonneville Lock below the downstream limit of fuel taxes on the Columbia River. A specific act by Congress can override a general provision of law. As a result, there is no clear precedent for where Trust Fund monies can be expended.

To date, $415.2 million has been withdrawn from the fund, $24.5 million in FY87, $62.1 million in FY88, $62.8 million in FY89, $117.3 million in FY90, and $148.6 million in FY91. Current expenditures are helping to fund the construction of eight lock projects authorized by the Water Resources Development Acts of 1986 and 1988: Bonneville, Gallipolis, Melvin Price (2nd lock chamber), Oliver, Grays Landing, Winfield, Point Marion, and Olmsted.

7.2 RECEIPTS

Trust Fund fuel taxes were first collected in FY81 at the rate of $.04 per gallon. The first year's revenue was $21.2 million. The balance in the Trust Fund grew rapidly in the early years because no expenditures were authorized by Congress until FY85. The fuel tax rate continued to increase, and interest earned on the Trust Fund balance increased as the balance increased. FY91 Trust Fund receipts were about $60 million. Interest on these receipts and the prior balance amounted to about $21.2 million. The balance in the Trust Fund at the end of FY91 was $225.9 million, according to the Treasury Department (Table 31).

Future receipts are linked to both the fuel consumption and the applicable tax rate. The forecast future receipts shown in Table 31 are based on an analysis using a growth rate of 1.5% per year in traffic, which is assumed will be matched by a similar growth rate in fuel consumption (see Historic Trends and Projections). No inflation factor is applied to the calculation of receipts. The forecast future annual revenues without accrued interest, grow from $81.9 million in FY93 to $107 million in FY2000 at a 1.5% growth rate. These revenues will be supplemented by interest earned on the balance in the Trust Fund. The balance will be affected by the number and cost of projects funded in a particular fiscal year. The increase in receipts is heavily influenced, as in previous years, by the doubling of the tax from $.10 per gallon in FY85 to $.20 per gallon in FY95.

Figure 41 shows the Trust Fund receipts, expenditures and balance from 1987 through 1991. The graph incorporates a 1.5% growth rate in receipts and 50% funding of eight authorized projects and three anticipated projects on the fuel tax waterways. Receipts include accrued interest on the balance from each previous year. Forecasts of future expenditures are based on project construction schedules as of October 1991, using OMB assumptions for inflation and interest rates, plus forecasts of expenditures for three projects not underway. On of the three is authorized (McAlpine) and two are under study. It should be noted that other potential projects are also under study or will be in the near future. These three are used in this analysis for illustrative purposes only to demonstrate the relative funding limitations of the Trust Fund with respect to future additional projects. Which projects will actually be authorized and funded for construction will be determined by Congress.

There is considerable uncertainty in estimates relating to forecasts of ton-miles. The impacts of the fuel tax increases on waterway traffic share is not known with certainty and may have different impacts on the movement of different commodities. Other sources of uncertainty include the overall increase in long-haul movements (especially grain export traffic), fluctuations in the price of diesel fuel, and the application of fuel efficiency measures to vessels.

TABLE 31. SUMMARY OF CASH FLOWS-INLAND WATERWAY TRUST FUND FOR NINE AUTHORIZED INLAND NAVIGATION PROJECTS PLUS MONTGOMERY POINT AND MONONGAHELA 3 & 4 (REPLACEMENT) OMB INFLATION (2%) AND INTEREST EARNED (6%)

(AS OF OCTOBER 1991)
($ MILLION)

FISCAL YEAR	ESTIMATED OUTLAYS	TAX REVENUES	INTEREST EARNINGS	YEAR-END BALANCES
1987	24.5	48.3	16.5	300.6
1988	62.1	48.1	24.3	310.8
1989	62.8	47.0	26.0	321.1
1990	117.3	62.8	26.1	292.8
1991	148.6	60.5	21.2	225.9
1992	114.3	70.5	18.4	200.5
1993	133.0	81.9	14.3	163.7
1994	161.4	92.9	11.4	106.6
1995	125.5	99.3	9.6	90.0
1996	108.0	100.8	9.5	92.3
1997	95.6	102.3	10.4	109.4
1998	105.9	103.8	6.8	114.1
1999	106.6	105.4	7.1	120.0
2000	122.5	106.9	7.5	112.0
2001	182.7	108.5	7.0	44.8
2002	151.8	110.2	2.8	6.0
2003	103.9	111.8	.4	14.3
2004	90.1	113.5	.9	38.6
2005	103.7	115.2	2.4	52.5
2006	127.6	116.9	3.3	45.1
2007	146.1	118.7	2.8	20.6
2008	130.9	120.5	1.3	11.4
2009	107.7	122.3	.7	26.7
2010	86.1	124.1	1.7	66.4

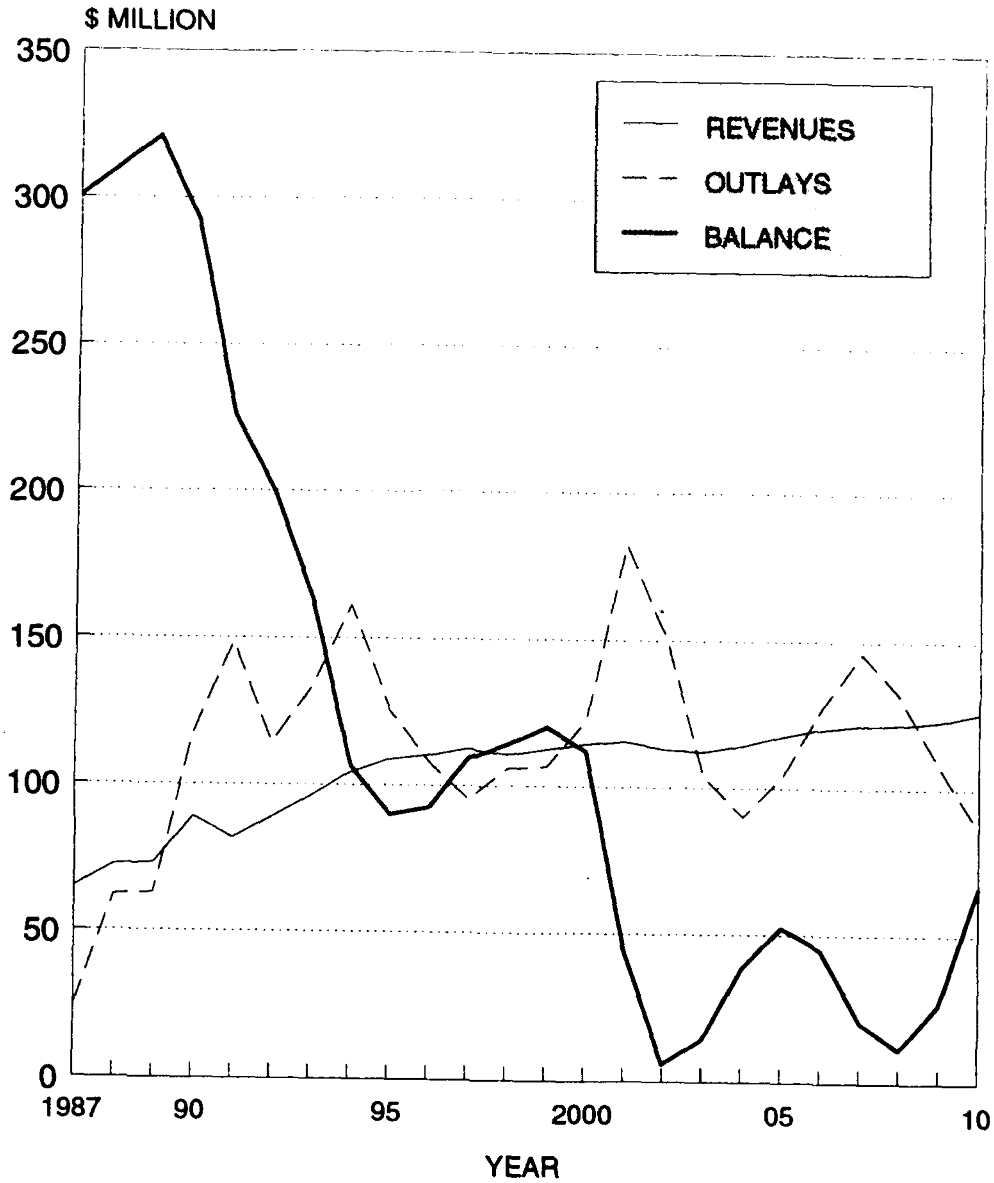


FIGURE 41: INLAND WATERWAYS TRUST FUND: REVENUES, OUTLAYS AND BALANCE FOR 11 PROJECTS

SOURCE: TREASURY AND IWR, MAY 90. BASED ON OMB GUIDANCE ON INFLATION AND INTEREST EARNED, USING 9 AUTHORIZED PROJECTS AND 2 UNDER STUDY

There is considerable uncertainty in estimates relating to forecasts of ton-miles. The impacts of the fuel tax increases on waterway traffic share is not known with certainty and may have different impacts on the movement of different commodities. Other sources of uncertainty include the overall increase in grain exports, which are generally long-haul movements, and the application of fuel efficiency measures to vessels.

7.3 EXPENDITURES

As noted, outlays from the Trust Fund shown in Table 31 are based on specific appropriations for eight authorized and three anticipated projects on the fuel tax waterways. The estimated cost of these projects and an estimate of the year in which construction could begin are presented in Table 32. Seven of these projects actively drew from the Trust Fund in FY90 and FY91. There are many additional projects currently under study which are candidates for future funding as well. In addition, problems may emerge in the next few years at projects not yet under study, creating another wave of funding needs. The total expenditures of $4,291.0 million for these eleven projects include an allowance for inflation during construction (based on OMB estimates). Out-year projections are best-estimates prepared by the Corps of Engineers and do not reflect fixed commitments or budget amounts for specific years. Outlays are scheduled to peak in FY94 and again in FY2001 at $161 and $183 million respectively, and the Trust Fund balance dips accordingly.

7.4 BALANCE

The balance in the Trust Fund was nearly $225.9 million at the end of FY91. The nine authorized and two candidate projects will reduce the balance to approximately $164 million in FY93. A second wave of peak outlays occurs in this analysis in FY2002 with concurrent funding of Olmsted, Montgomery Point, McAlpine and Monongahela 3 & 4 (replacement), reducing the balance to a low of $6 million in 2002 (Table 31). Additional projects only now coming under study would be candidates for funding in subsequent years, but the Trust Fund balance appears likely to be insufficient to fund a greater number of projects than the eleven analyzed here. However, in future years, as priority needs are assessed, Congress may choose to fund a different set of new projects than presented in this analysis. The principal issue to note is that under current revenue estimates, the funding capacity of the trust fund will be seriously constrained. If inflation runs higher than forecast by OMB, the initiation of construction at one or more projects might have to be delayed to allow sufficient revenues to accrue to the Trust Fund.

7.5 SUMMARY

Based on current analysis and OMB guidance on inflation and interest rates, the Trust Fund can provide for 50% funding of the nine projects now authorized and perhaps two additional projects in the FY90-FY2000 time frame. However, analysis indicates that several additional construction projects could exhaust the Trust Fund if scheduled as rapidly as current studies anticipate.

Therefore, an inland navigation budget priority process is unavoidable. The Office of the Chief of Engineers is currently coordinating the testing of such an effort in cooperation with three Corps divisions. There will undoubtedly be a significant budget constraint, surely from the Trust Fund and very likely from the General Tax Funds available to the U.S. Treasury. The budget priority system should be systemwide and based primarily on net system benefits available for each budget alternative, subject to budget constraints. This will inevitably lead to emphasis on lowering the capital intensity of many of the alternatives prepared for funding. Smaller scale investments for measures with high immediate payoff will attract funding priorities.

TABLE 32. SUMMARY OF NINE AUTHORIZED INLAND NAVIGATION PROJECTS PLUS MONTGOMERY POINT AND MONONGAHELA 2-4 (REPLACEMENT) OMB INFLATION (2%) AND INTEREST EARNED (6%)

OCT 1991

Project	Trust Fund Feasible Start	Construction Duration (Years)	Total Project Cost W/Inflation ($ Million)
Bonneville	1987	7	331.0
Gallipolis	1987	15	386.0
M Price (Aux)	1987	7	212.6
Oliver L&D	1987	7	118.0
Gray's Landing	1987	9	171.8
Point Marion	1987	8	99.1
Winfield	1988	10	236.0
Olmsted	1992	15	1,110.0
McAlpine	2006	4	415.9
Montgomery Pt	2004	6	241.5
Mon 2-4	2009	8	969.1
			4,291.0

APPENDICES

Appendix A

Inland Waterway Lock Projects on Fuel Taxed Segments

APPENDIX
TABLE A

INLAND WATERWAY LOCK PROJECTS ON FUEL TAX SEGMENTS

SEGMENT NUMBER 1 -- UPPER MISSISSIPPI

	LOCK NAME OR NUMBER	RIVER MILE	YEAR OPENED	AGE IN 2000	CHAMBER WIDTH (feet)	LENGTH (feet)	LIFT (feet)
1	Upper St. Anthony Falls	853.9	1963	37	56	400	49
2	Lower St. Anthony Falls	853.3	1959	41	56	400	25
3	No. 1 Main Chamber	847.6	1930	70	56	400	38
	No. 1 Auxiliary Chamber	847.6	1932	8	56	400	38
4	No. 2 Main Chamber	815.0	1930	70	110	500	12
	No. 2[1] Auxiliary Chambe	815.0	1948	52	110	600	12
5	No. 3	769.9	1938	62	110	600	8
6	No. 4	752.8	1935	65	110	600	7
7	No. 5	738.1	1935	65	110	600	9
8	No. 5a	728.5	1936	64	110	600	5
9	No. 6	714.0	1936	64	110	600	6
10	No. 7	702.0	1937	63	110	600	8
11	No. 8	679.0	1937	63	110	600	11
12	No. 9	647.0	1938	62	110	600	9
13	No. 10	615.0	1936	64	110	600	8
14	No. 11	583.0	1937	63	110	600	11
15	No. 12	556.0	1938	62	110	600	9
16	No. 13	522.0	1938	62	110	600	11
17	No. 14 Main Chamber	493.3	1939	61	110	600	11
17	No. 14 Auxiliary Chamber	493.1	1922	78	80	320	11
18	No. 15 Main Chamber	482.9	1934	66	110	600	16
18	No. 15 Auxiliary Chamber	482.9	1934	66	110	360	16
19	No. 16	457.2	1937	63	110	600	9
20	No. 17	437.1	1939	61	110	600	8
21	No. 18	410.5	1937	63	110	600	10
22	No. 19	364.2	1957	43	110	1200	38
23	No. 20	343.2	1936	64	110	600	10
24	No. 21	324.9	1938	62	110	600	10
25	No. 22	301.2	1938	62	110	600	10
26	No. 24	273.4	1940	60	110	600	15
27	No. 25	241.4	1939	61	110	600	15
28	Price L&D Main Chamber	200.8	1990	10	110	1200	24
28	Price Aux. (under const.)	200.8	1992	8	110	600	24

SEGMENT NUMBER 2 -- MIDDLE MISSISSIPPI

1	L&D 27 Main Chamber	185.1	1953	47	110	1200	21
1	L&D 27 Auxiliary Chamber	185.1	1953	47	110	600	21
2	Kaskaskia	0.8	1973	27	84	600	32

SEGMENT NUMBER 3 -- LOWER MISSISSIPPI

	ARKANSAS RIVER						
1	Norrell	10.3	1967	33	110	600	30
2	Lock 2 & Mills Dam	13.3	1967	33	110	600	20
3	L&D 3	50.2	1968	32	110	600	20
4	L&D 4	66.0	1968	32	110	600	14
5	L&D 5	86.3	1968	32	110	600	17
6	David T. Terry	108.1	1968	32	110	600	18
7	Murray	125.4	1969	31	110	600	18
8	Toad Suck	155.9	1969	31	110	600	16
9	Ormond	176.9	1969	31	110	600	20
10	Dardanelle	205.5	1969	31	110	600	55
11	Ozark	256.8	1969	31	110	600	34
12	James W. Trimble	292.8	1969	31	110	600	20
13	W. D. Mayo	319.6	1970	30	110	600	21
14	Robert S. Kerr	336.2	1970	30	110	600	48
15	Webbers Falls	366.6	1970	30	110	600	30
16	Chouteau (Verd. R)	401.5	1970	30	110	600	21
17	Newt Graham (Verd. R)	421.6	1970	30	110	600	21

APPENDIX
TABLE A (CONTINUED)

INLAND WATERWAY LOCK PROJECTS ON FUEL TAX SEGMENTS

SEGMENT NUMBER 3 -- LOWER MISSISSIPPI -- CONTINUED

	LOCK NAME OR NUMBER	RIVER MILE	YEAR OPENED	AGE IN 2000	CHAMBER WIDTH (feet)	CHAMBER LENGTH (feet)	LIFT (feet)
	OUACHITA & BLACK RIVERS						
18	Jonesville	25.0	1972	28	84	600	30
19	Columbia	117.2	1972	28	84	600	18
20	Felsenthal	226.8	1984	16	84	600	18
21	Thatcher	281.7	1984	16	84	600	12
	RED RIVER						
22	L&D 1	28.7	1984	16	84	600	36
23	Overton	88.0	1987	13	84	600	36
	L&D 3 (under construction)	140.0	1991	9	84	600	36
	ATCHFALAYA (OLD) RIVER						
24	Old River	304.0	1963	37	75	1200	35

SEGMENT NUMBER 4 -- ILLINOIS WATERWAY

1	LaGrange L&D	80.2	1939	61	110	600	10
2	Peoria L&D	157.7	1939	61	110	600	11
3	Starved Rock L&D	231.0	1933	67	110	600	19
4	Marseilles L&D	244.6	1933	67	110	600	24
5	Dresden Island L&D	271.5	1933	67	110	600	22
6	Brandon Road L&D	286.0	1933	67	110	600	34
7	Lockport Lock	291.1	1933	67	110	600	40
8	T.J. O'Brien Lock	326.5	1960	40	110	1000	5

SEGMENT NUMBER 5 -- OHIO RIVER SYSTEM

	OHIO RIVER						
1	Emsworth	974.8	1921	79	110	600	18
	Emsworth Second Chamber		1921	79	56	360	18
2	Dashields	967.7	1929	71	110	600	10
	Dashields Second Chamber		1929	71	56	360	10
3	Montgomery	949.3	1936	64	110	600	18
	Montgomery Second Chamber		1936	64	56	360	18
4	New Cumberland	926.6	1959	41	110	1200	21
	New Cumberland Second Chamber		1959	41	110	600	21
5	Pike Island	896.7	1968	32	110	1200	21
	Pike Island Second Chamber		1968	32	110	600	21
6	Hannibal	854.6	1972	28	110	1200	21
	Hannibal Second Chamber		1972	28	110	600	21
7	Willow Island	819.3	1972	28	110	1200	20
	Willow Island Second Chamber		1972	28	110	600	20
8	Belleville	777.1	1968	32	110	1200	22
	Belleville Second Chamber		1968	32	110	600	22
9	Racine	743.5	1971	29	110	1200	22
	Racine Second Chamber		1971	29	110	600	22
10	Gallipolis	701.8	1937	63	110	600	23
	Gallipolis Second Chamber		1937	63	110	360	23
10	Gallipolis (under const.)	701.8	1992	8	110	1200	23
	Gallipolis Second Chamber		1992	8	110	600	23
11	Greenup	640.0	1959	41	110	1200	30
	Greenup Second Chamber		1959	41	110	600	30
12	Meldahl	544.8	1962	38	110	1200	30
	Meldahl Second Chamber		1962	38	110	600	30
13	Markland	449.5	1963	37	110	1200	35
	Markland Second Chamber		1963	37	110	600	35
14	McAlpine First Chamber[2]	374.2	1921	79	56	360	37
	McAlpine Second Chamber		1930	70	110	600	37
	McAlpine Third Chamber		1961	39	110	1200	37
15	Cannelton	260.3	1972	28	110	1200	25
	Cannelton Second Chamber		1972	28	110	600	25
16	Newburgh	204.9	1975	25	110	1200	16
	Newburgh Second Chamber		1975	25	110	600	16
17	Uniontown	135.0	1975	25	110	1200	18
	Uniontown Second Chamber		1975	25	110	600	18

APPENDIX
TABLE A (CONTINUED)

INLAND WATERWAY LOCK PROJECTS ON FUEL TAX SEGMENTS

SEGMENT NUMBER 5 -- OHIO RIVER SYSTEM -- CONTINUED

	LOCK NAME OR NUMBER	RIVER MILE	YEAR OPENED	AGE IN 2000	CHAMBER WIDTH (feet)	LENGTH (feet)	LIFT (feet)
18	Smithland	35.3	1980	20	110	1200	22
	Smithland		1980	20	110	1200	22
19	L&D 52	42.1	1969	31	110	1200	12
	L&D 52 Second Chamber		1928	72	110	600	12
20	L&D 53	18.4	1980	20	110	1200	12
	L&D 53 Second Chamber		1929	71	110	600	12
	Olmsted (Replaces 53 & 5?)	---	1999	1	110	1200	--
	Olmsted Second Chamber	---	1999	1	110	1200	--
	MONONGAHELA RIVER						
21	L&D 2	11.2	1951	49	110	720	9
	L&D 2 Second Chamber		1953	47	56	360	9
22	L&D 3	23.8	1907	93	56	720	8
	L&D 3 Second Chamber		1907	93	56	360	8
23	L&D 4	41.5	1932	68	56	720	17
	L&D 4 Second Chamber		1932	68	56	360	17
24	Maxwell	61.2	1964	36	84	720	20
	Maxwell Second Chamber		1964	36	84	720	20
25	Grays Landing (L&D 7)	85.0	1925	75	56	360	15
	Grays Landing (under const.)	82.0	1993	7	84	720	15
26	Point Marion (L&D 8)	90.8	1925	75	56	360	19
	Point Marion (under const.)	90.8	1993	7	84	720	19
27	Morgantown	102.0	1950	50	84	600	17
28	Hildebrand	108.0	1959	41	84	600	21
29	Opekiska	115.4	1964	36	84	600	22
	ALLEGHENY RIVER						
30	L&D 2	6.7	1934	66	56	360	11
31	L&D 3	14.5	1934	66	56	360	14
32	L&D 4	24.2	1927	73	56	360	11
33	L&D 5	30.4	1927	73	56	360	12
34	L&D 6	36.3	1928	72	56	360	12
35	L&D 7	45.7	1930	70	56	360	13
36	L&D 8	52.6	1931	69		360	18
37	L&D 9	62.2	1938	62	56	360	22
	KANAWHA RIVER						
38	Winfield	31.1	1937	63	56	360	28
	Winfield Second Chamber		1937	63	56	360	28
	Winfield Third Chamber (under const.)	31.1	1995	5	110	800	28
39	Marmet	67.8	1934	66	56	360	24
	Marmet Second Chamber		1934	66	56	360	24
40	London	82.8	1934	66	56	360	24
	London Second Chamber		1934	66	56	360	24
	KENTUCKY RIVER						
41	L&D 1	4.0	1839	161	38	145	8
42	L&D 2	31.0	1839	161	38	145	14
43	L&D 3	42.0	1844	156	38	145	13
44	L&D 4	65.0	1844	156	38	145	13
	GREEN & BARREN RIVERS						
45	L&D 1	9.1	9156	44	84	600	12
46	L&D 2	63.1	1956	44	84	600	14
	CUMBERLAND RIVER						
47	Barkley	30.6	1964	36	110	800	57
48	Cheatham	148.7	1964	36	110	800	25
49	Old Hickory	216.2	1954	46	84	400	60
50	Cordell Hull	313.5	1973	27	84	400	59
	TENNESSEE & CLINCH RIVERS						
51	Kentucky	22.4	1944	56	110	600	56
52	Pickwick	206.7	1937	63	110	600	55
	Pickwick Second Chamber		1983	17	110	1000	55
53	Wilson	259.4	1927	73	60	300	94
	Wilson Second Chamber		1927	73	60	292	--
	Wilson Third Chamber		1959	41	110	600	94
54	Wheeler	274.9	1963	37	110	600	48
	Wheeler Second Chamber		1934	66	60	400	48
55	Guntersville	349.0	1965	35	110	600	39
	Guntersville Second Chamber		1937	63	60	360	39

INLAND WATERWAY LOCK PROJECTS ON FUEL TAX SEGMENTS

SEGMENT NUMBER 5 -- OHIO RIVER SYSTEM -- CONTINUED

	LOCK NAME OR NUMBER	RIVER MILE	YEAR OPENED	AGE IN 2000	CHAMBER WIDTH (feet)	LENGTH (feet)	LIFT (feet)
56	Nickajack	424.7	1967	33	110	600	39
57	Chickamauga	471.0	1939	61	60	360	49
58	Watts Bar	529.9	1941	59	60	360	58
59	Ft. Loudon	602.3	1943	57	60	360	72

SEGMENT NUMBER 6 -- GULF INTRACOASTAL WATERWAY

	LOCK NAME OR NUMBER	RIVER MILE	YEAR OPENED	AGE IN 2000	CHAMBER WIDTH (feet)	LENGTH (feet)	LIFT (feet)
	GULF INTRACOASTAL WATERWAY						
1	Inner Harbor[3]	92.6	1923	77	75	640	17
2	Harvey Lock[4]	98.2	1935	65	75	425	20
3	Algiers Lock[5]	88.0	1956	44	75	760	18
4	Bayou Boeuf Lock	93.3	1954	46	75	1156	11
5	Leland Bowman Lock	162.7	1985	15	110	1200	5
6	Calcasieu Lock	238.5	1950	50	75	1206	4
7	Brazos River E. Fldgt	404.1	1954	46	75	---	--
	Brazos River W. Fldgt	404.1	1954	46	75	---	--
8	Colorado River E. Lock	444.8	1954	46	75	1200	5
	Colorado River W. Lock	444.8	1954	46	75	1200	5
	GIWW, MORGAN CITY TO PORT ALLEN ROUTE						
9	Port Allen[6]	227.6	1961	39	84	1202	45
10	Bayou Sorrel - GIWW	36.7	1952	48	56	747	21
	APALACHICOLA, CHATTAHOOCHEE, & FLINT RIVERS						
11	Jim Woodruff	106.3	1954	46	82	450	33
12	George W. Andrews	154.3	1962	38	82	450	25
13	Walter F. George	182.8	1963	37	82	450	88
	PEARL RIVER						
14	Lock 1	28.7	1951	49	65	310	17
15	Lock 2	40.8	1951	49	65	310	15
16	Lock 3	14.0	1951	49	65	310	11

SEGMENT NUMBER 7 -- MOBILE RIVER AND TRIBUTARIES

	LOCK NAME OR NUMBER	RIVER MILE	YEAR OPENED	AGE IN 2000	CHAMBER WIDTH (feet)	LENGTH (feet)	LIFT (feet)
	BLACK WARRIOR RIVER						
1	John Hollis Bankhead	365.7	1975	25	110	600	68
2	Holt	347.0	1966	34	110	600	64
3	Wm. Bacon Oliver	337.6	1991	9	110	600	28
4	Selden (Warrior)	261.7	1957	43	110	600	22
	TOMBIGBEE RIVER						
5	Demopolis	213.2	1954	46	110	600	40
6	Coffeeville	116.6	1960	40	110	600	34
	ALABAMA RIVER						
7	Claiborne	81.2	1969	31	84	600	30
8	Millers Ferry	142.3	1969	31	84	600	48
9	Robert F. Henry	245.4	1972	28	84	600	45
	TENNESSEE-TOMBIGBEE WATERWAY						
10	Gainesville	49.1	1978	22	110	600	36
11	Aliceville	89.8	1979	21	110	600	27
12	Columbus	117.6	1980	20	110	600	27
13	Aberdeen	140.0	1985	15	110	600	27
14	A	154.0	1985	15	110	600	30
15	B	159.3	1985	15	110	600	25
16	C	174.0	1985	15	110	600	25
17	D	181.0	1985	15	110	600	30
18	E	189.0	1985	15	110	600	30
19	Bay Springs	194.9	1985	15	110	600	84

APPENDIX
TABLE A (CONTINUED)

INLAND WATERWAY LOCK PROJECTS ON FUEL TAX SEGMENTS

SEGMENT NUMBER 8 -- ATLANTIC INTRACOASTAL WATERWAY

	LOCK NAME OR NUMBER	RIVER MILE	YEAR OPENED	AGE IN 2000	CHAMBER WIDTH (feet)	LENGTH (feet)	LIFT (feet)
	ALBEMARLE & CHESAPEAKE CANAL ROUTE						
1	Great Bridge	11.5	1932	68	75	600	3
	DISMAL SWAMP CANAL ROUTE						
2	South Mills	33.2	1941	59	52	300	12
3	Deep Creek	10.6	1940	60	52	300	12

SEGMENT NUMBER 9 -- COLUMBIA-SNAKE-WILLAMETTE

	LOCK NAME OR NUMBER	RIVER MILE	YEAR OPENED	AGE IN 2000	CHAMBER WIDTH (feet)	LENGTH (feet)	LIFT (feet)
	COLUMBIA & SNAKE RIVERS						
1	Bonneville[7]	146.0	1938	62	76	500	65
	Bonneville (under const.)[8]	146.0	1993	7	86	675	65
2	The Dalles	190.0	1957	43	86	675	88
3	John Day	215.0	1968	32	86	675	110
4	McNary	282.0	1953	47	86	675	75
5	Ice Harbor	9.7	1962	38	86	675	100
6	Lower Monumental	41.6	1969	31	86	675	98
7	Little Goose	70.3	1970	30	86	675	98
8	Lower Granite	107.5	1975	25	86	675	100
	WILLAMETTE RIVER						
9	Willamette Falls Locks	26.4	1873	127	40	210	20(5chs)

1. Not operational

2. Not operational

3. Not operational

4. Not operational

5. Not operational

6. Miles above Mississippi River Head of Passes

7. Not on fuel tax segment, but construction funded by Trust Fund.

8. Not on fuel tax segment, but construction funded by Trust Fund.

Appendix B

1990 Lock Performance Monitoring System Data

APPENDIX TABLE B

PERFORMANCE MONITORING SYSTEM

1990 PMS DATA FOR WATERWAY SYSTEMS LOCKS

LOCK NAME	AVERAGE DELAY TIME (MIN)	AVERAGE PROCESSING TIME (MIN)	TOTAL DELAY TIME (HRS)	TOTAL STALL TIME (HRS)	TOTAL NO. OF STALLS	LOCK UTIL. RATE (%)	LOCK TRAFFIC (MILLIONS OF TONS)
#1 UPPER MISSISSIPPI							
UPPER ST. ANTHONY (UPPER MISS)	1	12	38	4	7	41	1.2
LOWER ST. ANTHONY (UPPER MISS)	2	14	36	3	5	41	1.5
L&D 1 (UPPER MISS)	1	12	65	1	2	44	1.5
L&D 2 (UPPER MISS)	9	22	1181	5	2	61	14.2
L&D 3 (UPPER MISS)	7	16	1167	25	10	61	14.1
L&D 4 (UPPER MISS)	6	18	806	3	3	58	14.7
L&D 5 (UPPER MISS)	7	23	694	2	2	57	14.7
L&D 5A (UPPER MISS)	7	19	681	1	2	55	14.9
L&D 6 (UPPER MISS)	8	23	1104	8	3	60	17.0
L&D 7 (UPPER MISS)	10	22	1456	47	14	61	17.0
L&D 8 (UPPER MISS)	15	34	1494	11	11	60	17.5
L&D 9 (UPPER MISS)	10	29	893	14	9	59	18.3
L&D 10 (UPPER MISS)	12	34	1417	5	4	60	20.9
L&D 11 (UPPER MISS)	23	45	3574	77	37	66	20.4
L&D 12 (UPPER MISS)	27	56	3137	38	20	59	24.7
L&D 13 (UPPER MISS)	24	50	2952	61	50	63	25.3
L&D 14 CHM 1 (UPPER MISS)	163	220	13351	105	39	70	31.6
L&D 14 CHM 4 (UPPER MISS)	0	5	0	0	0	68	0.0
L&D 15 CHM 1 (UPPER MISS)	176	260	10166	933	525	70	31.5
L&D 15 CHM 4 (UPPER MISS)	3	11	72	208	18	30	0.4
L&D 16 (UPPER MISS)	77	133	6522	103	78	77	34.1
L&D 17 (UPPER MISS)	178	250	12721	86	48	81	37.3
L&D 18 (UPPER MISS)	120	177	10228	80	97	80	37.7
L&D 19 (UPPER MISS)	41	85	3467	72	60	45	39.2
L&D 20 (UPPER MISS)	247	316	18954	961	87	65	39.8
L&D 21 (UPPER MISS)	102	162	8748	302	77	65	40.8
L&D 22 (UPPER MISS)	218	288	18556	285	83	73	41.4
L&D 24 (UPPER MISS)	241	304	22687	183	391	73	42.4
L&D 25 (UPPER MISS)	127	177	14312	175	204	70	42.3
MELVIN PRICE CHM 1 (MID MISS)	163	197	31574	520	500	82	79.9
MELVIN PRICE CHM 4 (MID MISS)	173	246	510	5	33	96	0.5
#2 MIDDLE MISSISSIPPI							
L&D 27 CHM 1 (MID MISS)	73	113	9644	239	73	68	74.1
L&D 27 CHM 4 (MID MISS)	140	168	11374	950	41	31	11.3
KASKASKIA (MID MISS)	1	13	39	11	8	13	3.4
#3 LOWER MISSISSIPPI							
NORRELL (McCLELLAN-KERR)	2	32	61	8	7	12	5.8
L&D 2 (McCLELLAN-KERR)	6	45	160	8	8	16	5.9
L&D 3 (McCLELLAN-KERR)	4	34	86	21	6	7	5.5
EMMETT SANDERS (McCLELLAN-KERR)	4	34	92	20	4	8	5.2
L&D 5 (McCLELLAN-KERR)	3	32	56	0	0	14	4.7
DAVID TERRY (McCLELLAN-KERR)	3	26	71	1	1	12	4.7
MURRAY (McCLELLAN-KERR)	4	24	34	0	1	15	4.0
TOAD SUCK FERRY (McCLELLAN-KERR)	3	40	45	5	2	11	3.9
ARTHUR ORMOND (McCLELLAN-KERR)	4	45	53	7	5	10	4.1
DARDANELLE (McCLELLAN-KERR)	8	44	124	3	2	12	3.7
OZARK (McCLELLAN-KERR)	6	47	75	6	3	12	3.7
JAMES TRIMBLE (McCLELLAN-KERR)	5	38	105	4	2	14	4.1
W.D. MAYO (McCLELLAN-KERR)	2	42	48	14	11	12	3.5
ROBERT S. KERR (McCLELLAN-KERR)	4	50	57	12	13	12	3.5
WEBBERS FALLS (McCLELLAN-KERR)	3	59	51	3	3	13	3.5
CHOUTEAU (McCLELLAN-KERR)	2	56	20	0	0	10	3.0
NEWT GRAHAM (McCLELLAN-KERR)	3	71	31	1	1	9	2.9

APPENDIX TABLE B (con't)

PERFORMANCE MONITORING SYSTEM

1990 PMS DATA FOR WATERWAY SYSTEMS LOCKS

LOCK NAME	AVERAGE DELAY TIME (MIN)	AVERAGE PROCESSING TIME (MIN)	TOTAL DELAY TIME (HRS)	TOTAL STALL TIME (HRS)	TOTAL NO. OF STALLS	LOCK UTIL. RATE (%)	LOCK TRAFFIC (MILLIONS OF TONS)
#3 LOWER MISSISSIPPI (CONT.)							
JONESVILLE (OUACHITA & BLACK)	1	24	9	0	1	4	0.8
COLUMBIA (OUACHITA & BLACK)	2	28	11	0	0	8	0.6
FELSENTHAL (OUACHITA & BLACK)	2	8	0	0	0	30	0.0
H.K. THATCHER (OUACHITA & BLACK)	3	12	0	1	1	29	0.0
L&D 1 (RED R.)	4	22	65	3	2	16	1.7
JOHN H. OVERTON (RED R.)	6	39	78	11	2	14	1.6
OLD RIVER (OLD RIVER)	15	64	659	44	24	25	6.3
BERWICK (ATCHAFALYA)	2	19	20	2	2	42	0.1
#4 ILLINOIS WATERWAY							
T.J. O'BRIEN (ILLINOIS)	0	9	118	8	8	30	7.7
LOCKPORT (ILLINOIS)	44	96	3789	102	41	53	17.4
BRANDON ROAD (ILLINOIS)	36	87	3182	36	69	54	17.5
DRESDEN (ILLINOIS)	20	54	2344	27	22	47	19.7
MARSEILLES (ILLINOIS)	38	83	4035	135	122	60	21.5
STARVED ROCK (ILLINOIS)	24	62	2662	34	43	51	23.7
PEORIA (ILLINOIS)	36	57	3218	84	33	22	32.9
LAGRANGE (ILLINOIS)	78	108	5292	67	37	26	36.0
#5 OHIO RIVER SYSTEM							
BELLEVILLE CHM 1 (OHIO)	13	67	671	28	7	33	36.5
BELLEVILLE CHM 4 (OHIO)	1	23	8	1	1	8	0.5
RACINE CHM 1 (OHIO)	50	102	1428	1524	47	39	32.0
RACINE CHM 4 (OHIO)	85	136	1750	1055	24	29	6.4
GALLIPOLIS CHM 1 (OHIO)	301	406	18597	1606	83	82	39.5
GALLIPOLIS CHM 2 (OHIO)	199	243	5851	26	8	16	2.1
GREENUP CHM 1 (OHIO)	26	77	2258	15	6	50	52.5
GREENUP CHM 4 (OHIO)	7	40	173	0	0	14	1.6
MELDAHL CHM 1 (OHIO)	38	94	2536	413	10	49	50.5
MELDAHL CHM 4 (OHIO)	32	48	2433	9	3	17	2.6
WILLOW ISLAND CHM 2 (OHIO)	14	69	704	12	5	31	33.3
WILLOW ISLAND CHM 4 (OHIO)	18	41	476	497	6	6	0.6
EMSWORTH CHM 1 (OHIO)	42	101	3267	98	80	55	21.8
EMSWORTH CHM 4 (OHIO)	3	20	113	17	18	21	0.9
DASHIELDS CHM 1 (OHIO)	60	124	4768	132	71	62	23.8
DASHIELDS CHM 4 (OHIO)	67	83	285	3382	16	10	0.2
MONTGOMERY CHM 1 (OHIO)	63	132	4547	83	109	60	25.2
MONTGOMERY CHM 4 (OHIO)	5	22	109	212	12	11	0.3
NEW CUMBERLAND CHM 1 (OHIO)	16	74	816	30	14	35	29.1
NEW CUMBERLAND CHM 4 (OHIO)	15	45	532	570	7	17	1.7
PIKE ISLAND CHM 1 (OHIO)	16	65	909	108	10	34	34.4
PIKE ISLAND CHM 4 (OHIO)	18	46	159	628	10	15	1.5
HANNIBAL CHM 1 (OHIO)	20	72	1052	133	66	35	35.5
HANNIBAL CHM 4 (OHIO)	66	98	704	895	13	7	0.6
MARKLAND CHM 2 (OHIO)	28	82	2144	77	31	49	50.8
MARKLAND CHM 4 (OHIO)	34	61	970	961	5	20	0.5
McALPINE CHM 2 (OHIO)	39	84	4495	93	85	62	56.7
McALPINE CHM 4 (OHIO)	2	10	0	0	0	66	0.0
L&D 52 CHM 1 (OHIO)	61	80	11612	53	46	39	95.4
L&D 52 CHM 5 (OHIO)	28	67	715	15	16	78	3.8
CANNELTON CHM 2 (OHIO)	49	104	4441	119	82	59	59.4
CANNELTON CHM 4 (OHIO)	3	27	14	2	4	9	0.5
NEWBURGH CHM 2 (OHIO)	32	77	3548	28	71	58	68.9
NEWBURGH CHM 4 (OHIO)	1	22	42	1	2	17	2.9
UNIONTOWN CHM 2 (OHIO)	50	92	6653	74	105	65	79.9
UNIONTOWN CHM 4 (OHIO)	1	17	19	2	9	15	0.6

APPENDIX TABLE B (con't)

PERFORMANCE MONITORING SYSTEM

1990 PMS DATA FOR WATERWAY SYSTEMS LOCKS

LOCK NAME	AVERAGE DELAY TIME (MIN)	AVERAGE PROCESSING TIME (MIN)	TOTAL DELAY TIME (HRS)	TOTAL STALL TIME (HRS)	TOTAL NO. OF STALLS	LOCK UTIL. RATE (%)	LOCK TRAFFIC (MILLIONS OF TONS)
#5 OHIO RIVER SYSTEM (CONT.)							
SMITHLAND CHM 1 (OHIO)	23	63	2087	382	84	42	55.2
SMITHLAND CHM 2 (OHIO)	18	54	1627	203	43	39	34.8
L&D 2 CHM 2 (MONON)	21	68	1250	124	13	36	18.3
L&D 2 CHM 4 (MONON)	4	16	234	76	4	13	0.6
L&D 3 CHM 1 (MONON)	17	51	1754	109	17	41	17.4
L&D 3 CHM 4 (MONON)	3	20	147	132	9	17	1.1
L&D 4 CHM 1 (MONON)	23	68	1882	111	8	46	15.5
L&D 4 CHM 4 (MONON)	8	30	275	186	5	15	0.5
MAXWELL CHM 1 (MONON)	6	37	394	243	34	26	5.0
MAXWELL CHM 2 (MONON)	6	37	326	229	25	24	10.3
L&D 7 (MONON)	43	93	3801	181	34	62	12.6
POINT MARION (MONON)	23	67	1894	94	29	49	10.4
MORGANTOWN (MONON)	8	35	173	206	5	12	1.9
OPEKISKA (MONON)	47	67	347	579	2	10	0.6
HILDEBRAND (MONON)	1	28	8	6	10	8	0.6
L&D 2 (ALLEGHENY)	5	19	336	2	2	30	2.4
L&D 3 (ALLEGHENY)	6	27	320	25	12	25	2.5
L&D 4 (ALLEGHENY)	4	18	232	130	15	17	1.4
L&D 5 (ALLEGHENY)	3	15	105	90	4	17	0.1
L&D 6 (ALLEGHENY)	7	21	78	139	3	15	0.1
L&D 7 (ALLEGHENY)	11	25	99	204	2	15	0.1
L&D 8 (ALLEGHENY)	20	36	76	544	6	33	0.5
L&D 9 (ALLEGHENY)	1	10	0	0	0	44	0.0
WINFIELD CHM 1 (KANAWHA)	324	453	14764	1870	212	94	13.8
WINFIELD CHM 2 (KANAWHA)	268	369	14378	347	264	88	7.4
MARMET CHM 1 (KANAWHA)	140	250	4663	477	45	74	9.1
MARMET CHM 2 (KANAWHA)	168	253	7058	2064	58	70	5.3
LONDON CHM 1 (KANAWHA)	281	354	2586	3584	291	32	2.8
LONDON CHM 2 (KANAWHA)	108	167	3447	2501	531	37	3.4
KENTUCKY (TENNESSEE)	142	213	12089	186	321	79	28.9
PICKWICK CHM 1 (TENNESSEE)	44	106	2320	525	363	49	18.1
PICKWICK CHM 5 (TENNESSEE)	573	606	2329	6797	408	33	0.3
WILSON (TENNESSEE)	23	77	1003	114	65	45	10.4
WHEELER CHM 1 (TENNESSEE)	28	86	909	425	241	35	9.7
WHEELER CHM 5 (TENNESSEE)	474	492	0	6738	220	47	0.0
GUNTERSVILEE CHM 1 (TENNESSEE)	19	50	908	586	262	9	7.4
GUNTERSVILLE CHM 5 (TENNESSEE)	609	630	210	7030	209	15	0.0
NICKAJAC (TENNESSEE)	9	44	268	96	63	21	5.2
CHICKAMAUGA (TENNESSEE)	8	23	425	21	15	38	2.2
WATTS BAR (TENNESSEE)	22	51	211	475	48	29	1.5
FORT LOUDON (TENNESSEE)	66	97	717	1987	269	25	0.6
BARKLEY (CUMBERLAND)	44	81	549	1089	101	22	3.0
CHEATHAM (CUMBERLAND)	14	43	319	459	122	18	4.6
OLD HICKORY (CUMBERLAND)	44	65	934	2353	376	-3	0.8
L&D 1 (GREEN)	2	16	121	3	1	16	10.3
L&D 2 (GREEN)	1	21	31	3	1	10	5.4
#6 GULF INTRACOASTAL							
PORT ALLEN (GIWW)	219	187	32719	16532	5151	74	27.6
BAYOU SORREL (GIWW)	178	234	28089	289	72	72	27.6
INNER HARBOR (GIWW)	516	550	148374	2397	229	93	23.4
ALGIERS (GIWW)	167	226	40438	92	41	88	24.8
HARVEY (GIWW)	81	116	12621	540	301	51	3.6
BAYOU BOEUF (GIWW)	19	47	8047	68	37	66	27.6
CALCASIEU (GIWW)	71	103	19273	1205	518	76	46.3
LELAND BOWMAN (GIWW)	56	95	15438	40	12	72	45.9
SCHOONER BAYOU (GIWW)	5	10	19273	0	0	5	0.1

*

APPENDIX TABLE B (con't)

PERFORMANCE MONI OKING SYSTEM

1990 PMS DATA FOR WATERWAY SYSTEMS LOCKS

LOCK NAME	AVERAGE DELAY TIME (MIN)	AVERAGE PROCESSING TIME (MIN)	TOTAL DELAY TIME (HRS)	TOTAL STALL TIME (HRS)	TOTAL NO. OF STALLS	LOCK UTIL. RATE (%)	LOCK TRAFFIC (MILLIONS OF TONS)
#6 GULF INTRACOASTAL (CONT.)							
CATFISH (GIWW)	3	13	88	0	0	6	0.4
COLORADO R. EAST (GIWW)	2	7	389	44	5	23	18.6
COLORADO R. WEST (GIWW)	2	6	447	10	5	21	18.8
BRAZOS EAST (GIWW)	28	31	6072	3922	397	18	19.1
BRAZOS WEST (GIWW)	34	37	6930	4943	451	17	18.9
JIM WOODRUFF (APALACHICOLA)	54	74	1385	1384	28	7	0.6
#7 MOBILE RIVER & TRIBS							
DEMOPOLIS (BLACK WARRIOR & TOMBIGBEE)	20	60	1719	114	30	44	18.6
CLAIBORNE (ALABAMA-COOSA)	0	25	0	0	0	13	1.3
GAINESVILLE (TENN-TOM)	5	39	130	22	6	17	4.1
BAY SPRINGS (TENN-TOM)	0	26	4	0	1	12	2.2
#8 ATLANTIC INTRACOSTAL							
DEEP CREEK (DISMAL SWAMP)	22	33	0	0	0	6	0.0
SOUTH MILLS (DISMAL SWAMP)	3	12	0	0	0	5	0.0
ALBEMARLE & CHEASPEAKE (AIWW)	2	10	96	0	0	24	0.9
#9 COLUMBIA-SNAKE WATERWAY							
* BONNEVILLE (COLUMBIA)	79	181	439	6	2	94	1.8
McNARY (COLUMBIA)	6	37	155	16	10	15	7.8
ICE HARBOR (SNAKE)	32	57	1557	1429	20	19	5.1
LOWER MONUMENTAL (SNAKE)	9	40	135	28	11	13	4.2
LITTLE GOOSE (SNAKE)	6	29	80	7	10	10	4.0
LOWER GRANITE (SNAKE)	8	27	61	0	0	11	3.8

* No data available for January and May 1991.

Appendix C

Inland Waterways Trust Fund Analysis
(as of March 1992)

APPENDIX C

ASSESSMENT OF ALTERNATIVE ASSUMPTIONS OF OUTLAYS AND REVENUES FOR THE INLAND WATERWAYS TRUST FUND

QUALIFYING STATEMENT AND DISCLAIMER:

This document presents revenue, outlays and balance projections for the Inland Waterways Trust Fund based on specified assumptions of growth in receipts, Treasury forecasts for interest rates and Corps of Engineer forecasts of potential outlays. These projections are for macro-planning purposes only. No final determination of the economic justification or environmental acceptability of projects, no final decision on the cost, size, or location of future projects shown, and no Administration or Corps of Engineers commitment to request funds to proceed with potential construction are implied with this analysis except for projects under construction or proposed for construction in the FY92 Budget.

DISCUSSION:

The following analysis of the Inland Waterways Trust Fund is based on available information from the Life Cycle Project Management (LCPM) system and guidance provided by the Planning Division, HQUSACE. The analysis makes assumptions using OMB guidance on inflation (3.1%) and Treasury Department guidance on interest rates (ranging from 8.75% in the near term down to 6.250% after 1997). Both assumptions are unchanged from the last analysis presented to the Users Board.

The following Trust Fund analysis presents a modified list of projects from those presented at the last meeting of the Users Board in October 1991. Specifically, projects are included for Sargents Beach and Upper Mississippi Locks 15-18, while Kentucky and Montgomery Point have been omitted. Other projects analyzed remain the same, including 8 committed new starts and 8 other potential projects, plus rehabilitation expenditures for two locks on the Upper Mississippi, multiple locks on the Illinois, and other locations to be determined ("future rehabilitation").

Due to continuing uncertainties over the type, cost and location of a replacement lock for Inner Harbor, it has been omitted from this analysis.

Other assumptions have been kept constant from prior analyses presented to the Users Board, including:

- Incremental increases in the fuel tax rate as established in the Water Resources Development Act of 1986;

- An annual growth rate in fuel consumption of 1.5% after 1997 (the mid-range of traffic growth scenarios presented in the Institute for Water Resources' <u>1988 Inland Waterway Review</u>). Near-term assumptions for fuel consumption growth rates were developed in coordination with the Treasury Department.

- A Trust Fund balance on 30 September 1991 of $216.9 million, as reported by the U.S. Department of the Treasury. Projected annual receipts to and outlays from the Trust Fund are calculated from this starting base.

CHANGES FROM EARLIER ANALYSES:

Annual project funding allocations have been adjusted based on the latest information from LCPM and Programs Division. Inflation, interest rates and total project cost estimates are essentially unchanged from the last analysis. The impact on the Trust Fund was analyzed for construction of 21 new or replacement locks plus an ongoing rehabilitation program to be funded 50% from the Trust Fund. Total rehabilitation expenditures include $40.5 million at Upper Mississippi Locks 13 and 15 between 1993 and 1996, $32.7 million for multiple locks on the Illinois between 1993 and 1996, and annual rehab outlays for yet to be designated projects beginning in 1994 of $40 million per year (including the Upper Miss and Illinois projects). The $40 million per year outlay for major rehabilitation ($20 million from the Trust Fund) is held constant. If the rehab outlay were to be inflated, as in the last analysis, the impact would be longer intervals between new project starts of 1-2 years.

FINDINGS:

As can be seen in Tables 1 and 2, the Trust Fund can accommodate current construction schedules for 8 projects and the major rehabilitations planned for the Upper Miss and the Illinois. In addition, proposed projects for Sargents Beach (beginning in 1995) and McAlpine (1996) can also be accommodated based on current schedules. However, due to the high cost of Mon 2-4, the Mon project must be delayed by three years from 1997 to 2000. Likewise, the proposed construction start at Marmet in 1997 must be delayed until 2003 to accommodate Mon 2-4. Each of the Upper Miss locks (which are as yet unscheduled) can then be initiated in 3-4 year intervals thereafter (based on a 1992 cost of $380 million each and an inflation rate of 3.1%). The last of the 21 projects, Upper Miss Lock 15, is completed by 2038.

It should be noted that the sequence of project construction used in this analysis is based on the order in which projects could be feasibly intiated from a study and engineering standpoint in the absence of any funding constraint, according to LCPM and Programs Division estimates. This sequence has been retained through the Trust Fund analysis, but it does not represent a determination of funding priorities.

TABLE C-1

INLAND WATERWAYS TRUST FUND
21 PROJECTS - PLUS REHABILITATION
(8 COMMITTED NEW STARTS AND 13 POTENTIAL PROJECTS)

Project	Prog Div Scheduled Start	Trst Fnd Feasible Start	Construction Duration (Years)	Total Trust Fund Draws with Inflation	Total Project Cost w/ Inflation
Bonnevlle	1987	1987	8	165,500,000	331,000,000
Gallipols	1987	1987	14	192,000,000	384,000,000
LD26/Prc	1987	1987	7	106,300,000	212,600,000
Oliver	1987	1987	7	60,000,000	120,000,000
Grays Lnd	1987	1987	9	85,900,000	171,800,000
Pt Marion	1987	1987	8	49,550,500	99,100,000
Winfield	1988	1988	10	118,000,000	236,000,000
Olmsted	1992	1992	15	555,000,000	1,110,000,000
UM Rehab	1993	1993	4	20,230,000	40,460,000
Il WW Rhb	1993	1993	4	16,350,000	32,700,000
Fut Rehab	1994	1994	66*	1,320,000,000	2,640,000,000
Sarg Bch	1995	1995	4	45,339,500	90,679,000
McAlpine	1996	1996	6	158,000,000	316,000,000
Mon 2-4	1997	2000	10	515,079,560	1,030,159,119
Marmet	1997	2003	7	132,112,733	264,225,466
UM 25	Unsch	2006	6	314,128,061	628,256,121
UM 24	Unsch	2010	6	354,928,926	709,857,851
UM 22	Unsch	2012	6	377,275,606	754,551,211
UM 21	Unsch	2016	6	426,278,458	852,556,916
UM 20	Unsch	2019	6	467,164,015	934,328,029
UM 18	Unsch	2022	6	511,971,019	1,023,942,038
UM 17	Unsch	2026	6	578,468,932	1,156,937,863
UM 16	Unsch	2029	6	633,951,501	1,267,903,003
UM 15	Unsch	2033	6	716,292,982	1,432,585,963

*Future rehabilitation expenditures assumed level at $40 million per year ($20 million from Trust Fund) beginning in 1994. Cumulative expenditures to 2060 are shown for illustration as part of this Trust Fund model analysis.

NOTES: Assumes HQUSACE Programs Division budget allocation schedules on an annual basis. Scheduled start years are from Programs Division.

TABLE C-2

INLAND WATERWAYS TRUST FUND
21 PROJECTS -- PLUS REHABILITATION
(8 COMMITTED NEW STARTS AND 13 POTENTIAL PROJECTS)

YEAR	ESTIMATED OUTLAYS	TAX REVENUES	INTEREST EARNINGS	YEAR-END BALANCES
1991				216,900,000
1992	111,471,000	70,500,000	16,946,397	192,875,397
1993	126,633,000	83,000,000	13,140,601	162,382,998
1994	180,106,000	95,000,000	10,657,196	87,934,194
1995	148,248,000	104,000,000	5,715,723	49,401,917
1996	140,470,000	108,000,000	3,180,495	20,112,412
1997	105,598,000	111,000,000	1,269,697	26,784,109
1998	101,139,500	112,665,000	1,674,007	39,983,615
1999	86,350,000	114,354,975	2,498,976	70,487,566
2000	89,984,906	116,070,300	4,405,473	100,978,433
2001	134,698,820	117,811,354	6,311,152	90,402,119
2002	122,381,334	119,578,524	5,650,132	93,249,442
2003	150,801,670	121,372,202	5,828,090	69,648,064
2004	159,521,374	123,192,785	4,353,004	37,672,479
2005	141,455,446	125,040,677	2,354,530	23,612,241
2006	127,055,593	126,916,287	1,475,765	24,948,700
2007	132,761,996	128,820,032	1,559,294	22,566,030
2008	147,210,550	130,752,332	1,410,377	7,518,189
2009	129,453,650	132,713,617	469,887	11,248,043
2010	102,612,102	134,704,321	703,003	44,043,265
2011	104,652,145	136,724,886	2,752,704	78,868,710
2012	146,459,792	138,775,759	4,929,294	76,113,972
2013	165,323,572	140,857,396	4,757,123	56,404,919
2014	167,558,240	142,970,257	3,525,307	35,342,243
2015	149,811,794	145,114,811	2,208,890	32,854,150
2016	119,219,187	147,291,533	2,053,384	62,979,880
2017	121,669,329	149,500,906	3,936,243	94,747,699
2018	126,569,614	151,743,419	5,921,731	125,843,235
2019	173,286,016	154,019,571	7,865,202	114,441,992
2020	154,016,371	156,329,864	7,152,625	123,908,110
2021	179,418,849	158,674,812	7,744,257	110,908,329
2022	187,988,106	161,054,934	6,931,771	90,906,929
2023	166,870,255	163,470,758	5,681,683	93,189,115
2024	194,709,156	165,922,820	5,824,320	70,227,098
2025	147,992,755	168,411,662	4,389,194	95,035,199
2026	154,642,546	170,937,837	5,939,700	117,270,190
2027	157,967,442	173,501,904	7,329,387	140,134,040
2028	164,617,233	176,104,433	8,758,377	160,379,617
2029	228,012,383	178,746,000	10,023,726	121,136,960

TABLE G-2 (Con't)

INLAND WATERWAYS TRUST FUND
21 PROJECTS -- PLUS REHABILITATION
(8 COMMITTED NEW STARTS AND 13 POTENTIAL PROJECTS)

YEAR	ESTIMATED OUTLAYS	TAX REVENUES	INTEREST EARNINGS	YEAR-END BALANCES
2030	201,863,065	181,427,190	7,571,060	108,272,144
2031	236,334,769	184,148,597	6,767,009	62,852,982
2032	178,487,875	186,910,826	3,928,311	75,204,245
2033	186,722,023	189,714,489	4,700,265	82,896,975
2034	190,839,097	192,560,206	5,181,061	89,799,145
2035	199,073,245	195,448,609	5,612,447	91,786,955
2036	199,073,245	198,380,338	5,736,685	96,830,733
2037	127,443,947	201,356,043	6,051,921	176,794,750
2038	91,629,298	204,376,384	11,049,672	300,591,507
2039	20,000,000	207,442,030	18,786,969	506,820,506

Appendix D

1991 Annual Report
of the
Inland Waterways User Board

INLAND WATERWAYS USERS BOARD FIFTH ANNUAL REPORT TO THE SECRETARY OF THE ARMY AND THE UNITED STATES CONGRESS DECEMBER 1991

IV. RECOMMENDATIONS

Preamble. The following recommendations are made from the Board's perspective of prioritizing projects based on needs for navigation improvements throughout our waterways system. These recommendations were derived after discussions which reflected the positions of shippers who use the waterways system to move their commodities, and carriers who must operate on the system to serve the shippers. The Board recognizes that there are valid, important, and justifiable reasons why a project that has not received high priority from the Board is vigorously supported by others. Some of these reasons are national defense, economic and regional development, flood control, recreation, or other local or national policy objectives. Congress obviously has the responsibility to factor all of these elements into its decision-making process. The Board's charge is narrower, and Board recommendations to delay or terminate a project should not be viewed as expressing an opinion on the value of such a project beyond its importance to navigation and shipping interests as evaluated by the Board.

The preamble to the Board's recommendations should be considered an integral part of each of its recommendations. The Board's recommendations are as follows:

Category 1: Projects and studies which should be accelerated, if possible, consistent with maximum Corps capabilities or for which increased capabilities would be appropriate.

* Construction

  - Winfield Lock (Kanawha River).

The Board moved the Winfield Project from Category 2 to Category 1 to emphasize the hazardous and toxic waste issue that has emerged. During 1991, the immense magnitude of the hazardous and toxic waste contamination at the Winfield Lock site became increasingly clear to the Board. These problems have at this point delayed the current project completion schedule by two years, to at least 1997. Phase II construction solicitation for bids has been postponed. The Board strongly recommends accelerating the Corps' efforts to accurately identify the scope of the contamination problem and the cost of remediation efforts.

* Preconstruction Engineering and Design (PED)

  - Sargent Beach (GIWW-Texas).

The Board recognizes the accelerated beach erosion problem which is occurring in the vicinity of Sargent Beach on the Gulf Intracoastal Waterway (GIWW). If a breach occurs at

this point, a vital segment of the GIWW, from Freeport, Texas, to our border with Mexico, with its large industrial output, would be effectively shutdown. The consequences of a failure to properly protect and maintain the existing channel could require very costly emergency measures in the future.

The Board believes correction of the erosion at Sargent Beach should not be considered a navigation construction project to be cost-shared with the Inland Waterways Trust Fund. It is, rather, a beach erosion problem. The Corps of Engineers is charged with maintaining the navigation channel and Section 102(b) of Public Law 99-662 states "--The Federal share of the cost of operation and maintenance of any project for navigation on the inland waterways is 100 percent."

The Board understands the lack of resources available in the current Corps O&M budget to adequately fund the Sargent Beach Project and suggests a special emergency appropriation be sought to correct the erosion problems and maintain navigation on the GIWW in this area.

* GI Planning Studies

  - Upper Mississippi River & Illinois Waterway Studies.

  These were separate Planning Studies in 1990.

Category 2. Projects and studies which should proceed as planned in accordance with scheduled Corps capabilities.

* Construction

  - W.B. Oliver L&D (Black Warrior River).

  - Gallipolis L&D (Ohio River).

  - Melvin Price L&D (L&D 26 Second Lock - Upper Mississippi River).

  - Olmsted L&D (Replacement of L&D 52 & 53 - Ohio River).

  - Bonneville Lock (Columbia River).

  - Gray's Landing L&D (Monongahela River).

  - Point Marion L&D (Monongahela River).

  - Mississippi River Regulatory Works (MR&T).

  - McClellan-Kerr Arkansas River Waterway.

The Board believes that the proposed Montgomery Point Lock and Dam is included in the original authorization for the

McClellan-Kerr Navigation System and that funds for the project should be considered a 100 percent Federal responsibility.

The original McClellan-Kerr Navigation System authorization predates the creation of the Inland Waterways Trust Fund and Public Law 99-662, which provided cost-sharing of specified new projects in that Act and in subsequent Acts of Congress. The authorized construction account for completing the McClellan-Kerr Project is still open. In order to achieve the statutory intent contemplated by the authors of the McClellan-Kerr legislation, Montgomery Point Lock and Dam is included under the original provisions of Public Law 79-525, dated July 24, 1946. The Board considers the project to be grandfathered from the cost-sharing provisions of Public Law 99-662 and subsequent Acts.

The construction of this project appears necessary to the Board to protect the federal investment of over $1.5 billion and the equally high level investment for private regional development which has occurred in the basin of the McClellan-Kerr Navigation System.

At this time, the Board cannot recommend construction of the proposed project with cost-sharing derived from the Inland Waterways Trust Fund, as it does nothing to increase the design capacity of the system.

* Major Rehabilitation

    - Illinois Waterway L&Ds: Brandon Road, Dresden Island, Marseilles and Lockport.

    - Upper Mississippi River L&Ds: 13 and 15.

* Preconstruction Engineering and Design (PED)

    - McAlpine L&D (Ohio River).

    - Montgomery Point L&D (McClellan-Kerr System).

See the explanatory comments under the McClellan-Kerr Arkansas River Waterway, Category 2 Construction.

    - Monongahela River L&Ds 2, 3, 4.

    - Gulf Outlet Inner Harbor Canal Lock.

* GI Planning Studies

    - Marmet L&D (Kanawha River).

Category 3. Projects and studies which should be delayed due to low navigation priority.

* Construction

- None.

* <u>Preconstruction Engineering and Design (PED)</u>

  - Kentucky Lock (Tennessee River).

The Board, in its deliberations, noted that while significant and costly delays are occurring at Kentucky Lock, an alternative is available through the Kentucky/Barkley canal and Barkley Lock. While Barkley Lock, on the Cumberland River, provides a less than optimal alternative, it nevertheless is available in the near term until traffic levels build to the point where the Lower Cumberland River Channel becomes constrictive. Accordingly, the Board recommends: 1) that due to constrained funds, Kentucky Lock should be delayed; and 2) that traffic levels and the ability of the Lower Cumberland River to pass traffic be closely monitored by the Corps with periodic reports to the Board. The Corps should consider, in the near term, traffic management practices and small scale improvements, including bendway straightening, on the Cumberland River.

A Minority View with respect to the recommendation on Kentucky Lock is included as an Annex to this Appendix.

* <u>GI Planning Studies</u>

  - Uniontown L&D (Ohio River).

  - Algiers Lock (GIWW).

While the Board does not support the initiation of new feasibility studies at this time, it does support system-wide studies of the Ohio River and GIWW with a view towards more clearly identifying future needs.

  - Green-Barren Rivers.

  - London L&D (Kanawha River).

<u>Category 4</u>. Projects and studies on which priority recommendations should be deferred due to lack of information.

* No projects or studies in this category.

<u>Category 5</u>. Projects or studies which should be terminated.

* No projects or studies in this category.

APPENDIX N OF 1992 USERS BOARD ANNUAL REPORT

MINORITY VIEW WITH RESPECT TO THE RECOMMENDATION ON KENTUCKY LOCK

Messrs. Diehl, Quenon, Barchie, and Brown concur with the statements and recommendations contained in the December 1991 Annual Report to the Secretary of the Army and the United States Congress, with the exception of the recommendation on the Kentucky Lock from which they respectfully dissent.

At its October 1991 meeting, the Board voted to move the Kentucky Lock from its position in Category 1, Planning Studies, to Category 3, Preconstruction Engineering and Design. Category 3 includes projects and studies which should be delayed due to low navigation priority. We feel strongly that the Kentucky Lock should not have been placed in Category 3 and should instead be placed in Category 2 where it can proceed to the Preconstruction Engineering and Design phase in accordance with scheduled Corps capabilities.

The problems associated with Kentucky Lock and the lower Cumberland have been studied by the Corps of Engineers with unprecedented participation from the public during a span of 16 years. Throughout this period the Corps held numerous public meetings, workshops, interviews, and conferences involving shippers, carriers, agencies, and other interested parties. This participation was substantive and comprehensive. An example of this type of public involvement was the Feasibility Review Conference held in Paducah on August 7 and 8, 1990, and which included 18 representatives from companies using the Tennessee and Cumberland Rivers, three industry groups representing shippers and carriers using those rivers, eight state and federal agencies involved in safety, development, or environmental regulations, and Corps representatives from every administrative level. Participants were briefed in six areas: 1) plan formulation; 2) projections and benefits; 3) environmental; 4) project design; 5) cost estimates; and 6) construction. They were then asked to participate in working group sessions on each of these topics where differing views were encouraged and openly discussed. This conference was one of many similar meetings held by the Corps and we believe that with this type of input and participation, the Corps arrived at a sound study based on the facts and issues presented.

All of the issues raised in this year's Board report and discussed by the Board at its October 22, 1991 meeting as justification for lowering the priority of Kentucky Lock were fully studied and evaluated -- particularly those matters involving projected traffic, efficient use of the lower Cumberland through bendway straightening or one-way traffic, small scale improvements, and the timing and duration of lock outages at Kentucky Lock for maintenance closures. The conclusions on all of these issues, based on the data analyzed, resulted in a benefit/cost ratio of 1.5 for the replacement of

Kentucky Lock. In the absence of information which shows that the Corps' analysis was less than thorough, we believe that the project should proceed to the Preconstruction Engineering and Design phase.

We do not subscribe to the paradigm suggested by some on the Board which states that once a project gets to the Preconstruction Engineering and Design phase it achieves a life of its own and proceeds to construction regardless of new information which affects its feasibility. A project should be reviewed throughout its life to assure its continued priority.

It is obvious that our waterways have many needs and that there will always be potential alternative uses for construction dollars. However, an efficient planning and construction process will always require some element of queuing in the completion of projects, and those that are justifiable and farther ahead in the process shouldn't be delayed because of the possibility that a potentially more justifiable project might be identified in the future.

Appendix E

Assignment of New WCSC Commodity Codes to Corps Commodity Groups

APPENDIX E

ASSIGNMENT OF NEW WCSC COMMODITY CODES TO CORPS COMMODITY GROUPS

COMMODITY GROUP NO. AND NAME

COMMODITY CODE AND NAME

1. FARM PRODUCTS

6241	Wheat
6344	Corn
6442	Rice
6443	Barley & Rye
6445	Oats
6447	Sorghum Grains
6521	Peanuts
6522	Soybeans
6534	Flaxseed
6590	Oilseeds NEC
6653	Vegetable Oil
6654	Vegetables & Prod.
6746	Wheat Flour
6747	Grain Mill Products
6781	Hay & Fodder
6782	Animal Feed, Prep.
6811	Meat, Fresh, Frozen
6817	Meat, Prepared
6822	Diary Products
6835	Fish, Prepared
6838	Tallow, Animal Oils
6839	Animals & Prod. NEC
6856	Bananas & Plantains
6857	Fruit & Nuts NEC
6858	Fruit Juices
6861	Sugar
6865	Molasses
6871	Coffee
6872	Cocoa Beans
6885	Alcoholic Beverages
6887	Groceries
6888	Water & Ice
6889	Food Products NEC
6891	Tobacco & Products
6893	Cotton
6894	Natural Fibers NEC
6899	Farm Products NEC

COMMODITY CODE AND NAME

2. METALLIC ORES, PRODUCTS, AND SCRAP

4410	Iron Ore
4420	Iron & Steel Scrap
4630	Copper Ore
4650	Aluminum Ore
4670	Manganese Ore
4680	Non-Ferrous Scrap
4690	Non-Ferrous Ores NEC
4860	Slag
5312	Pig Iron
5315	Ferro Alloys
5320	I&S Primary Forms
5330	I&S Plates & Sheets
5360	I&S Bars & Shapes
5370	I&S Pipe & Tube
5390	Primary I&S NEC
5421	Copper
5422	Aluminum
5429	Smelted Prod. NEC
5480	Fab. Metal Products

3. COAL

1100	Coal & Lignite

4. CRUDE PETROLEUM

2100	Crude Petroleum

COMMODITY CODE AND NAME

5. NONMETALLIC MINERALS AND PRODUCTS

3271	Sulphur (Liquid)
4310	Building Stone
4322	Limestone
4323	Gypsum
4331	Sand & Gravel
4333	Dredged Material
4335	Waterway Improv. Mat.
4338	Soil & Fill Dirt
4741	Sulphur (Dry)
4782	Clay & Refrac. Mat.
4783	Salt
4900	Non-Metal. Min. NEC
5210	Lime
5220	Cement & Concrete
5240	Glass & Glass Prod.
5290	Misc. Mineral Prod.

6. FOREST PRODUCTS

4110	Rubber & Gums
4150	Fuel Wood
4161	Wood Chips
4170	Wood in the Rough
4189	Lumber
4190	Forest Products NEC
4225	Pulp & Waste Paper
5110	Newsprint
5120	Paper & Paperboard
5190	Paper Products NEC
5540	Primary Wood Prod.
7400	Manufac. Wood Products

COMMODITY CODE AND NAME

7. INDUSTRIAL CHEMICALS

3211	Acyclic Hydrocarbons
3212	Benzene & Toluene
3219	Other Hydrocarbons
3220	Alcohols
3230	Carboxylic Acids
3240	Nitrogen Func. Comp.
3250	Organo-Inorgan. Comp.
3260	Organic Comp. NEC
3272	Sulphuric Acid
3273	Ammonia
3274	Sodium Hydroxide
3275	Inorg. Elem., Oxides
3276	Metallic Salts
3279	Inorganic Chem. NEC
3281	Radioactive Material
3282	Pigments & Paints
3283	Coloring Mat. NEC
3284	Medicines
3285	Perfumes & Cleansers
3286	Plastics
3292	Starches, Gluten, Glue
3297	Chemical Additives
3298	Wood & Resin Chem.
3299	Chem. Products NEC

8. AGRICULTURAL CHEMICALS

3110	Nitrogenous Fert.
3120	Phosphatic Fert.
3130	Potassic Fert.
3190	Fert. & Mixes NEC
3291	Pesticides
4327	Phosphate Rock

COMMODITY CODE AND NAME	
9. PETROLEUM PRODUCTS	
1200	Coke
2211	Gasoline
2221	Kerosene
2330	Distillate Fuel Oil
2340	Residual Fuel Oil
2350	Lube Oil & Greases
2410	Petro. Jelly & Waxes
2429	Naphtha & Solvents
2430	Asphalt, Tar & Pitch
2540	Petroleum Coke
2640	Liquid Natural Gas
2990	Petro. Products NEC

COMMODITY CODE AND NAME	
10. ALL OTHER	
200	Vehicles
300	Passengers
3293	Explosives
4515	Marine Shells
7110	Machinery (Not Elec.)
7120	Electrical Machinery
7210	Vehicles & Parts
7220	Aircraft & Parts
7230	Ships & Boats
7300	Ordnance & Access.
7500	Textile Products
7600	Rubber & Plastic Pr.
7800	Empty Containers
7900	Manufac. Prod. NEC
8900	Waste and Scrap NEC
9900	Unknown or NEC